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MUNICIPAL AND INDUSTRIAL WATER USE



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WILLIAM R. GIANELLI

Director

Department of Water Resources

AUGUST 1968

RONALD REAGAN

Governor

State of California

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STATE OF CALIFORNIA
The Resources Agency
Department of Water Resources

BULLETIN No. 166-1

MUNICIPAL AND INDUSTRIAL WATER USE

AUGUST 1968

RONALD REAGAN
Governor
State of California

WILLIAM R. GIANELLI
Director
Department of Water Resources

FOREWORD

This report shows the water used per person in the community and assesses the factors known to influence such use. Studies of this kind are essential in the determination of future water requirements for the people of California.

This bulletin, covering generally the period 1961 through 1965, is the first in a planned series of reports dealing with urban water use in detail on a statewide basis. Other Department of Water Resources reports dealing extensively with urban water use in California are Bulletin No. 2, "Water Utilization and Requirements of California", June 1955; Bulletin No. 124, "Water Use by Manufacturing Industries in California, 1957-1959", April 1964, and Bulletin No. 160-66, "Implementation of the California Water Plan", March 1966.

The studies leading to this report were initiated under the provisions of Senate Bill 434 introduced by Senator Edwin J. Regan and passed by the 1959 session of the Legislature of the State of California. Specific authorization for these studies is set forth under Section 226(e) of the Water Code. Under subdivision (e), the State may "conduct investigations of the rate of use of water for various purposes and considering the various soil conditions".

The information presented in this report was developed to indicate past and current rates of urban water use and to provide a basis for estimating future water needs. Even more importantly, this report presents average monthly unit water use values, values which heretofore were not available.

The unit values presented in this report are based on measured and estimated water deliveries and on estimated population figures. The resulting data and analysis enable those concerned with planning and development of water resources and the operation of water projects to make more reliable estimates of water requirements and demands for project water.

William R. Gianelli

William R. Gianelli, Director
Department of Water Resources
The Resources Agency
State of California
June 28, 1968

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*Municipal and Industrial

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*Hydrographic Area

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State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES

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California Water Service Company
East Bay Municipal Utility District
San Diego County Water Authority
Los Angeles City Department of Water & Power
State Public Utilities Commission

ABSTRACT

Average monthly per capita water use, based generally on 1961-65 records from water agencies serving 54 percent of the State's population, is highest in June and lowest in January. However, within individual hydrographic areas, departures from the normal high and low months were caused by the influence of manufacturing establishments on water use, the length of the growing season, and the sample not being large enough to mask out the unusual monthly values. / Per capita water use during the growing season was found to be greatest in the San Joaquin Valley and lowest in the North Coastal Area. The desert areas show lower per capita use than the San Joaquin Valley because less water is used for outside watering. / During the winter, per capita water use in areas of the State that have moderate to high rainfall, such as the North Coastal Area, or low temperatures, such as the high desert areas, consist almost entirely of inside water use. In low-rainfall, temperate areas, however, per capita use during the winter frequently is strongly influenced by outside uses of water. / Residential water use is greater in a hot, arid climate than in a moist, cool climate, but climate has little effect on industrial and commercial water use. / Of the 61 cities and areas in the State for which historic annual unit water use data are reported, per capita water use has shown essentially no change in 44 cities and areas, has declined in 13 cities and areas, and has increased in 14 cities and areas. Areas of recent general increase in urban per capita water use are the North Coastal Area, the San Francisco Bay area, the Sacramento River Basin, the Delta--Central Sierra Basin, and the San Joaquin River Basin. Per capita water use is approaching equilibrium in cities in the Central Coastal Area, the South Coastal Area, and the Tulare Lake Basin. / This report, the first in a planned series dealing with municipal and industrial water use, presents per capita water use values for agency-produced water and for private, industry-produced fresh and brackish water. The data is summarized by hydrographic areas, counties, and cities. Also presented is information on the techniques used in developing the data and on factors that influence per capita water use.

CHAPTER I. INTRODUCTION *

This report presents per capita water use values for cities, counties and hydrographic areas throughout the State. The values have been developed from available data collected from a large number of water agencies and from many manufacturing establishments producing their own water. In each of the areas studied, water use has been influenced by a distinctive combination of factors. Many of these factors are discussed in this report to assist the user in more effectively applying the unit values shown.

Summary

Monthly per capita water use, based on records from water agencies serving 54 percent of the State's population, is highest in June and lowest in January. However, within individual hydrographic areas, departures from the normal high and low months were caused by the influence of manufacturing establishments on water use, the length of the growing season, and the sample not being large enough to mask out unusual monthly values.

water use is greater in a hot, arid climate than in a cool, moist climate, such as that near the coast. However, climate has little effect on water use by large industrial and commercial users.

During the winter, per capita water use in areas of the State that have moderate to high rainfall, such as the North Coastal area, or low temperatures, such as the high desert areas, consist almost entirely of inside water use. In low-rainfall, temperate areas, however, per capita use during the winter frequently is strongly influenced by outside uses of water. This influence exists because vegetation does not go dormant and because watering is necessary to sustain the plants.

Per capita water use becomes more climate-dependent during the growing season with increase in evaporative demand, except in the desert areas. The desert areas show lower per capita use during the growing season than some areas of more moderate climate because less water is used for outside watering. This condition exists because residential lots are smaller, tend to be less extensively landscaped, and are frequently planted to low-water-using types of vegetation. Per capita water use during growing seasons is greatest in the San Joaquin Valley and lowest in the North Coastal Area.

* Definitions of commonly used terms and abbreviations are presented in Appendix A.

Of the 61 cities and areas in the State for which historic annual unit water use data are reported (Table 11), per capita water use has shown essentially no change in 34 cities and areas, has declined in 13 cities and areas, and has increased in 14 cities and areas. General area-wide increases in per capita water use have occurred in the North Coastal Area, the San Francisco Bay Area, the Sacramento River Basin, the Delta--Central Sierra Basin, and the San Joaquin River Basin.

Per capita water use in cities in the Central Coastal Area, the South Coastal Area, and the Tulare Lake Basin is approaching equilibrium. Of the 44 cities in these areas for which unit water use data are reported (Table 11), 60 percent show little, if any, trend in per capita water use in the 15 years from 1951 through 1965. During the period 1958-62, these same cities reached a peak use, then declined slightly and stabilized.

Selection of Water Use Units

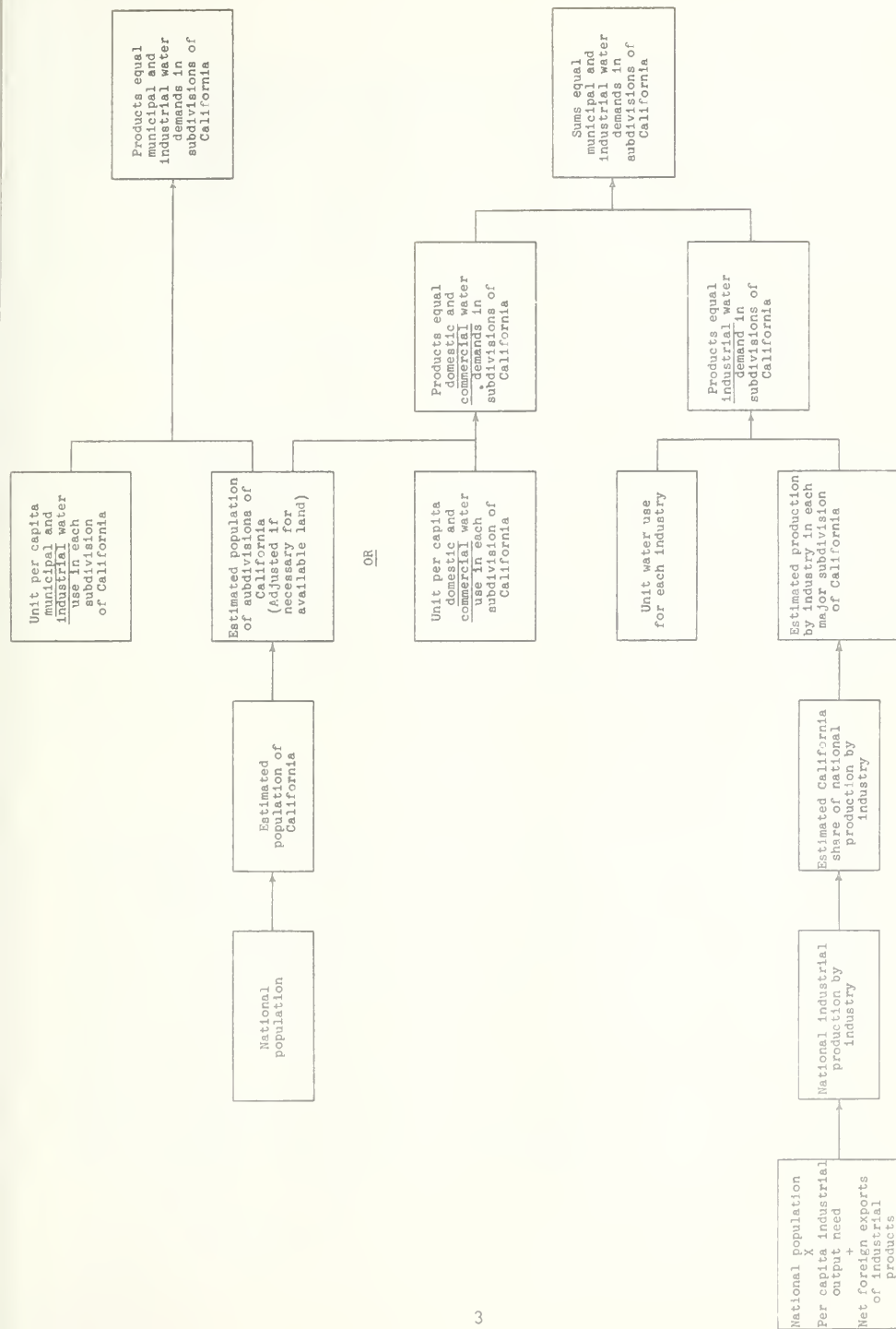
The water use units used in this report are gallons per capita per day (gpcd). These units have been found to be the most reliable for determining urban water use.

The selection of per capita units has been strongly influenced by the general procedure now used in the Department and shown in Figure 1 for calculating municipal and industrial* water use. Data of suitable quality and in sufficient quantity are available or easily acquired to make unit use calculations on this basis. On the other hand, use of area-depth units requires considerable effort, expense, and difficulty and lacks the flexibility for adjusting to new water use conditions that is inherent in the per capita approach.

Gallons per capita per day can be readily applied to residential, commercial, and recreational water use and to many smaller categories. The only urban water use for which per capita units have limited usefulness is industrial use, since normally there is little relationship between a community's changing population and its industrial use of water or between the area of industrial establishments of the same type and their use of water.

* Henceforth abbreviated M&I. In this report, the terms M&I and urban water use are used interchangeably.

Figure 1



TYPICAL FLOW CHART FOR
MUNICIPAL AND INDUSTRIAL WATER USE COMPUTATIONS

For industrial water use, employee-working-day unit values were found to provide a useful and reasonably accurate means for expanding reported uses of water by a segment of each industrial group to determine use for the entire group. These unit values and calculations, presented in Bulletin No. 124, were used as the basis for deriving per capita unit values for this report for counties or larger areas. The use of larger areas tends to dampen small-area fluctuations and to make the industrial water use values more population-dependent.

Composition of Urban Per Capita Water Use Values

Representative urban per capita water use values consist of values for agency-produced water and for privately produced water. Because the amount of available data on privately produced water in residential areas and commercial establishments is negligible, the only privately produced water that was considered was that produced by manufacturers. This water is divided into two categories: fresh and brackish.

Although considerable annual data were available on fresh and brackish water use by manufacturing establishments, monthly data were not available. Therefore, monthly per capita urban water use values are based exclusively on the use of agency-produced water. Future reports will contain data on the extent to which private, industry-produced water can alter monthly patterns of agency-produced water.

Types of Water Service Agencies

Municipal and industrial water service in California is provided by three types of water service agencies: publicly owned nonprofit agencies, privately owned nonprofit agencies, and privately owned profit-making agencies. These agencies do not include those individuals and companies that pump or divert water for their own use. In 1962, about 3,700 organizations were concerned with distributing water to the public in California.* Of these about 200 were municipally owned, 500 were commercial water companies, 1,400 were incorporated or unincorporated mutual groups, and 900 were water districts.

Uses of M&I Water

M&I water use consists of all uses of water associated with man, other than agricultural uses. In rural areas, residential water use includes some overlap between M&I and agricultural use. Water use at home sites that include

* Bulletin No. 114, "Directory of Water Service Agencies in California", June 1962.

a dwelling and an orchard or truck garden normally becomes an agricultural use if the area is larger than about 2 acres. This does not include large estates with extensive ornamental shrubbery and lawn areas.

In residential areas there are three primary uses of water.

1. Outside Uses (lawn and plant watering, swimming pool, car washing, and driveway sweeping).

2. Household Uses (clothes washing, dishwashing, garbage disposal, cooking and food preparation, evaporative coolers, and house cleaning).

3. Personal Uses (toilet flushing, bathing, other personal hygiene, and drinking).

Commercial establishments use water for many of the same purposes listed for residential areas. In addition, water is used in the form of steam or liquid for many types of commercial purposes.

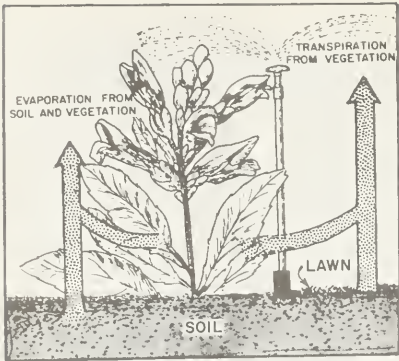
Industrial manufacturing establishments also use water for many outside, household, and **personal** purposes. Normally, the bulk of industrial water is used for cooling or for some industrial purpose.

Recreational water use includes residential and commercial uses, although usually in much smaller amounts than in urban areas.

Applied Water Components

Figure 2 shows a once-through disposition of water applied to an urban area. Also shown is the unaccountable water component which comprises water uses and losses not easily ascertainable.

Consumptive use, which is usually the largest of the three components comprising the applied water fraction, consists of two parts. Outside consumptive use consists of water used by urban-associated vegetation in transpiration and building of plant tissue, and water evaporated from soils, water surfaces, plant foliage, and impervious surfaces. Inside consumptive use consists of water evaporated during cooling, cleaning, and food preparation processes associated with residential, commercial, and industrial uses. Usually, only a small quantity of water is consumed or "lost" from the system in this manner.



OUTSIDE CONSUMPTIVE USE

"Outside consumptive use consists of water used by urban associated vegetation in transpiration and building plant tissue, and water evaporated from soils, water surfaces, plant foliage, and impervious surfaces."

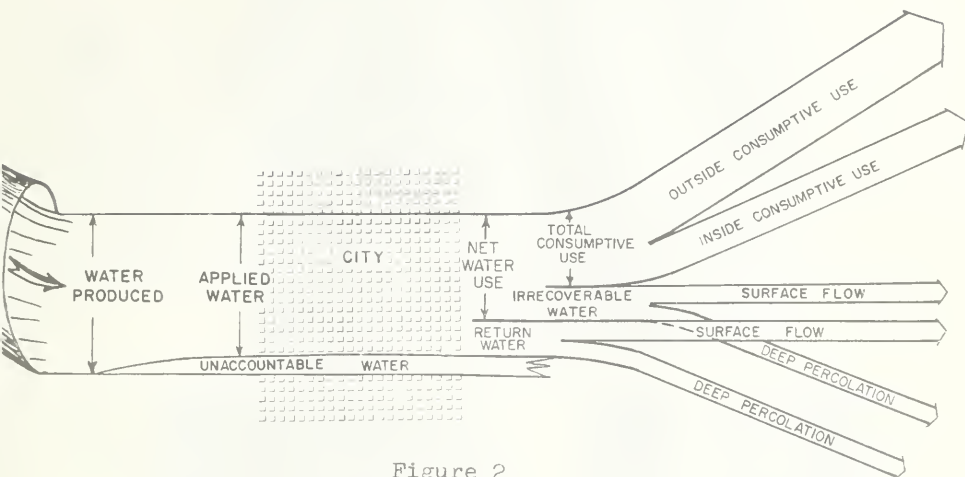


Figure 2
COMPONENTS OF URBAN WATER USE

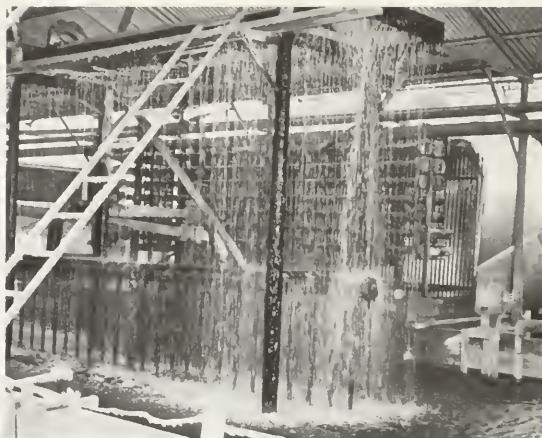
Irrecoverable water is water which either has been degraded in quality so that it is unsuitable for reuse* or has been discharged directly to the ocean or some other land or water body where it no longer is recoverable.

Consumptive use and irrecoverable water constitute net water use, or the amount of applied water actually lost from the water system. At present, little is known about the nature and magnitude of this value for urban complexes. The meager net water use data available relates mainly to industrial use.

Return water is not included in net water use because it can be recovered for reuse. It includes water which leaves the urban area surface by flow (to be picked up at some downstream point) or by deep percolation.

It should be recognized that Figure 2 is only a schematic and that no attempt has been made to depict an average or even a reasonable relationship of the components. The number of components and the volume of each can vary greatly between urban areas.

*Suitability for reuse is determined by economic considerations based on current methods of reclaiming water.



INSIDE CONSUMPTIVE USE

"Inside consumptive use consists of water evaporated during cooling, cleaning...processes associated with residential, commercial, and industrial uses."

Study Boundaries

In the selection of study boundaries, consideration was given to boundaries that would remain relatively stable in the future, would be hydrologically complete, and would be expected to be used for most planning studies. The regional boundaries selected were the hydrographic areas established for Bulletin No. 2, "Water Utilization and Requirements of California", modified in one area to permit comparisons with more recently established boundaries. These boundaries are shown on Figure 3. The modification consisted of detaching the northern portion of the San Joaquin River Basin from the basin shown in Bulletin No. 2 to form the Delta--Central Sierra Basin.

Future Activities

The Department will continue periodically to monitor per capita M&I water use of communities throughout the State. Where necessary and possible, information on privately produced water will be collected and related to population to obtain total per capita use for a given area.

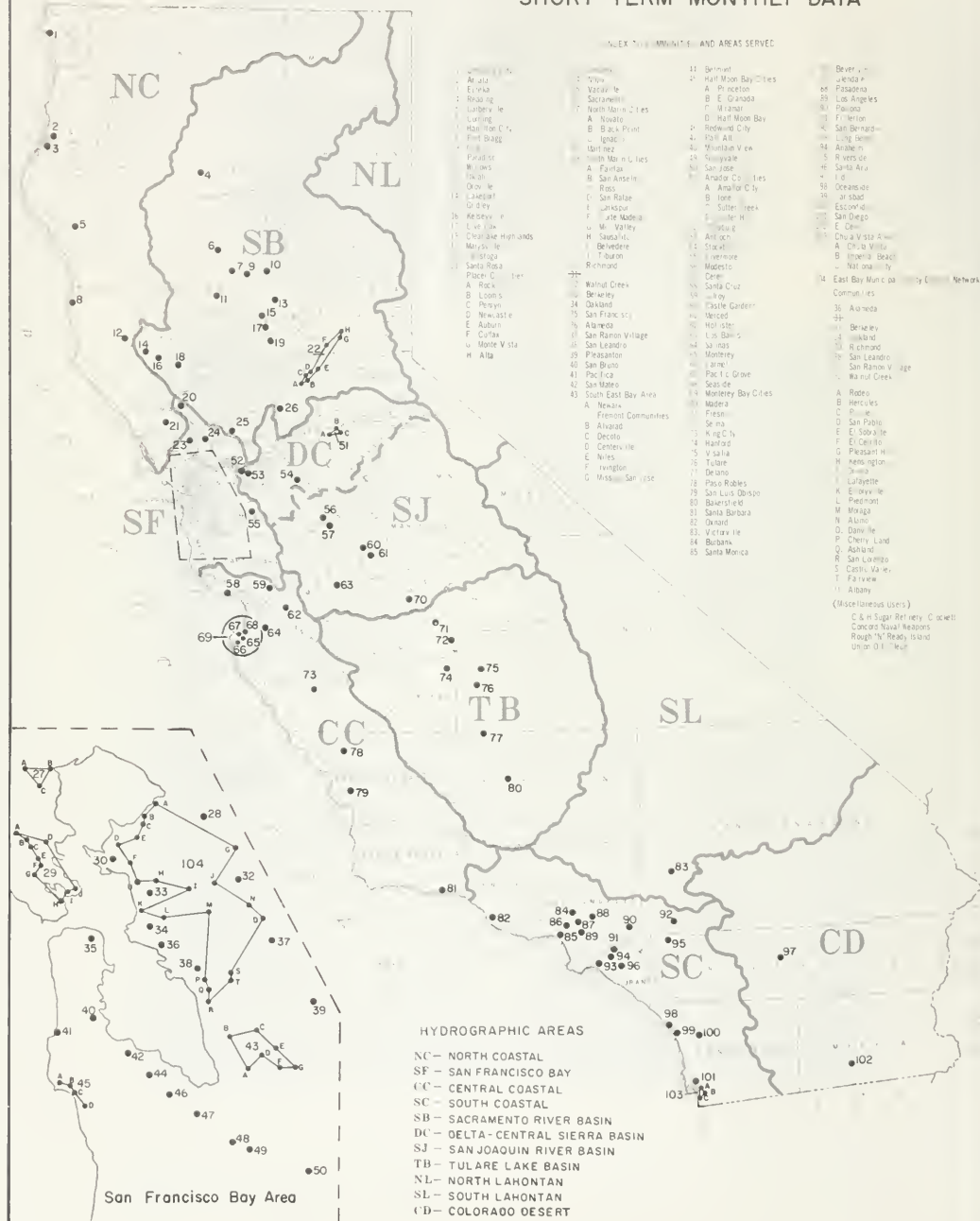
In accordance with planning requirements for industrial water use information, unit use values will be developed for major industrial categories and possibly for certain individual industries. Available data will be supplemented with new data as required to develop unit values on a unit-of-product or dollar-value-added basis.

Data will be obtained on the proportion of total M&I water that is applied outside of buildings and the proportion that is disposed of as sewage in the San Francisco Bay and South coastal metropolitan areas.

Data on annual and seasonal per capita unit water use in recreational areas will be obtained where such use is or will be significant.

In the major metropolitan areas, the factors that may significantly affect per capita M&I water use will be monitored. Where appropriate, municipal and industrial use will be monitored separately. If necessary, studies will be initiated to quantify the most important factors.

LOCATION OF CITIES PROVIDING SHORT-TERM MONTHLY DATA



CHAPTER II. FACTORS AFFECTING URBAN WATER USE

Factors that tend to increase or decrease unit values for urban water use have been quite well identified.* However, relatively little attention has been given to the importance of each to urban water use or to the development of a means of pre-determining, quantitatively, the net effect of a given set of variables on such use that will apply to a wide range of geographic, economic, and climate conditions. However, enough is known about the more important influencing factors to permit a qualitative evaluation of them. This evaluation will provide a useful basis for comparing water use between communities and areas, for developing an understanding of past water use trends, and for gaining an insight into future trends.

The factors which influence Municipal and Industrial Water Use rates may be grouped into two broad categories:

1. Climatic Factors
2. Man-Made Factors

Climatic Factors

Throughout most of California, climate is the predominant influence on M&I water use. In the hot, low-rainfall areas of the State, a close relationship usually exists between climate and urban water use due to the high outside use of water by vegetation. In the areas immediately adjacent to the coast, high humidity, foggy weather, and cool sea breezes may suppress outside use sufficiently to permit the non-vegetative, or inside use, components to determine the rate of use.

The influence of climatic factors is felt in two ways. Outside the home, the collective effect of various climatic factors determines the rate at which water is evaporated from wet surfaces and transpired from plants. This, the "evaporative demand", is the most important influence of climate. Inside the home during the summer, climate exerts a direct influence on use when man uses water for cooling to

* Partial list:

- "Domestic Water Use Planning", MEVA Corporation
- "A Study of Residential Water Use", Federal Housing Administration, U.S. Department of Housing and Urban Development
- "Water Use in the Mineral Industry", U.S. Bureau of Mines
- "Water Use by Manufacturing Industries in California 1957-59", Bulletin No. 124, Department of Water Resources, State of California
- "Factors Affecting Consumption of Urban Household Water in Northern Utah", Garder, B.D. and Schick, S.H. Bulletin 449. Agricultural Experiment Station, Utah State University. November 1964.

maintain a desirable comfort level. During June, July, and August, the water used for this purpose in the State's inland areas is appreciable. On the other hand, where refrigerant rather than water coolers are used, climate has little effect on inside use.

Temperature

Very little evaporation data has been collected in urban areas which can provide a good index of evaporative demand. However, to demonstrate the influence of climate on outside water use, temperature data, because of its availability and generally close relationship to outside water use, provides as good an index as does any single climatic factor.

To help isolate the temperature factor from other influencing factors such as rainfall and family income, the urban areas used in the examples below generally met the following requirements:

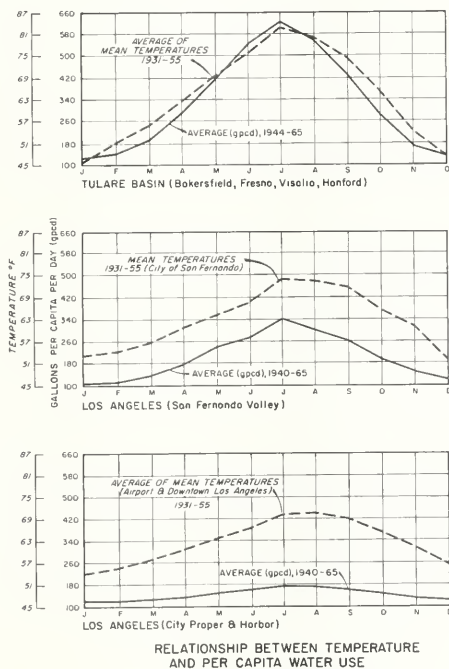
- Similar urban composition
- Extensive vegetated areas
- No special water use restrictions
- Large seasonal climatic fluctuations

The Department of Water Resources, in a study made in 1959 and reported upon in Bulletin No. 78, "Investigation of Alternative Aqueduct Systems to Serve Southern California", evaluated a number of factors believed to influence M&I water use. The investigators determined that the rate of water use is particularly sensitive to temperature fluctuations. This was demonstrated by plotting the monthly mean temperature for a particular city together with monthly water production for that city in three separate climatic zones in Southern California. The resulting water production curves closely followed the rise and fall of the temperature curves. The three areas and the average urban per capita water use for three periods are presented below.

| Area | Description | Average Urban Per Capita Water Use (gpcd) | | |
|------|---|---|---------|------|
| | | 1929-33 | 1953-56 | 1960 |
| 1 | San Luis Obispo, Santa Barbara, Ventura, Coastal Los Angeles, and Orange counties | 130 | 160 | 163 |
| 2 | San Fernando and San Gabriel Valleys | 140 | 190 | 214 |
| 3 | Antelope-Mojave Desert and the Upper Santa Ana River Basin | 148 | 212 | 231 |

The two main causes given for the higher use of water in the Antelope-Mojave Desert and the Upper Santa Ana River Basin area were evaporative air-conditioning and the extra water needed to sustain trees, shrubs, grass and other plants used for landscaping. The lower temperatures in the San Fernando and San Gabriel Valleys as shown in Figure 4, are largely responsible for the lower per capita use in this area. The curves show the relationship between long-term per capita water use and temperature data in two areas of Los Angeles and in the Tulare Lake Basin. Although the shapes of the curves are similar, the magnitude of the influence of temperature diminishes with approach to the coast. This occurs because summer fogs and ocean breezes introduce other climatic factors that lessen the temperature effect.

Figure 4



Other Climatic Factors

Rainfall, humidity, and wind also influence urban water use. Because the frequency and intensity of rainfall is quite variable, not only from area to area but with respect to time, the influence of this factor is also quite variable.

During growing seasons, for instance, an increase in the effective precipitation, which usually occurs during late spring and early fall, will generally reduce urban water use. Because of large yearly variations in spring precipitation, applied water requirements for urban areas during that season also fluctuate greatly. The greatest fluctuation usually occurs in March or April (Figure 10, Chapter IV).

In winter, vegetative water use requirements are very low. Dormancy, or near dormancy, of many species sharply reduces the need for water, and the remaining need can be more than satisfied by normal winter rains. On occasion, long rain-free periods do occur and gardens must be irrigated to sustain growth.

The amount of precipitation does not appear to be as important as when it occurs. A study by the Department in Southern California disclosed that while the rainfall in two years was 3.9 inches and 14.5 inches,* the total irrigation water applied during the second year to the lawns and shrubs of the 12 test homes decreased only 11 percent. During the first year, precipitation had been more or less evenly distributed, but most of the total precipitation during the second year occurred in one month. Thus, precipitation, depending upon its distribution, may or may not be an important influence on the amount of urban water use.

Outside water requirements generally decrease as humidity increases. Humidity is increased not only by proximity to the ocean or other bodies of water but also by irrigation and by extensive areas of vegetation. Data recorded at Fresno over a period of 75 years indicate a significant rise in summertime humidity, which coincides with the increase in acreage of irrigated land in the Central Valley during this period.

Daily measurements at the University of California at Davis indicate that wind accelerates evaporation and transpiration from water surfaces and plants. On excessively windy days plants may exercise partial control in the release of water. Moisture loss from free water surfaces or wet soil surfaces, however, increases proportionately to air movement.

Man-Made Factors

Factors influencing urban water use which are controlled by the people living and working in urban areas are conveniently grouped into two categories:

- Residential-Related Factors
- Other Urban-Related Factors

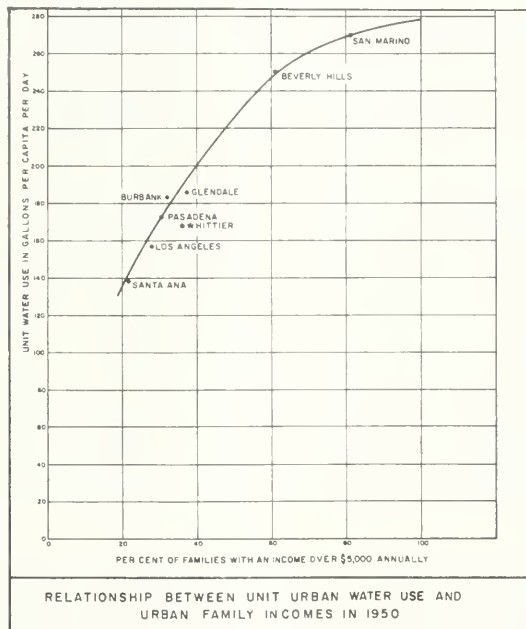
* "Residential Unit Water Use Survey, Rossmoor Tract, Orange County for the Period, April 1960-April 1962", November 1965, Office Report

Residential-Related Factors

Because most of the water used by a balanced urban community is used in residential areas, the residential-related factors of economic level, price of water, family size and age, metering, and sewerage generally influence total urban use more than other man-made factors.

Economic Level - A number of researchers* have established that the economic level of the consumer influences water use. This relationship was also confirmed in analyzing data for Appendix D (Economic Demand for Imported Water) of Bulletin No. 78, when the urban per capita water use and family income for 1950 were charted for eight communities in Southern California. The results are presented in Figure 5. Although the per capita values represent all urban uses rather than only residential use, values for the latter would give the same results.

Figure 5



- * - Larson, B. O. and Hudson, Jr., H. E., "Residential Water Use and Family Income", Jour. AWWA, August 1951.
- Hanson, R. and Hudson, Jr., H. E., "Trends in Residential Water Use", Jour. AWWA, Nov. 1956.
- Federal Housing Administration, U. S. Department of Housing and Urban Development, "A Study of Residential Water Use".
- Dunn, D. F. and Larson, T. E., "Relationship of Domestic Water Use to Assessed Valuation with Selected Demographic and Socio-Economic Variables", Jour AWWA, Apr. 1963

These studies agree that water use generally relates to family income, but they provide no quantitative correlations. While the reasons given for this vary between investigators, there appears to be general agreement that outside water use is most responsible for the correlation in most climatic zones. This is because the lots of homes of higher-income families are generally larger and therefore have higher sprinkler requirements.

Where climate or some other condition results in small outside use, opinions differ on whether the correlation will still hold. The study on residential water use conducted by the John Hopkins University for the Federal Housing Administration* indicates that the correlation does hold. This conclusion is based on a regression analysis of measurements of winter use of homes at various economic levels. Outside use was assumed to be negligible during the winter period**. The results gave a correlation coefficient of 0.76 within 95 percent confidence limits. No attempt was made to determine the contribution of personal and household uses in the correlation. The explanation offered for the correlation is that the consumer in a higher-valued area "is likely to have more water using appliances". Also, the appliances tend to be operated more frequently and at higher-than-average consumption rates.

Price of Water - The selling price of water is another economic factor which affects the rate of water use, but to a minor extent. In agricultural water use, as the price of water increases, its use decreases. This tendency in urban water use seems to be offset, however, by a sliding-scale pricing system used by most utilities, which varies the price of water inversely with the quantity used.

For cities reporting to the State Controller that showed an increase in price of water over a number of years, there generally did not appear to be any lasting reduction in use. Price caused a temporary reduction in usage following an increase in water charges but quickly rose to equal or exceed the previous rate.

Family Size and Age - The total water requirements of older dwellings in a community are usually less than those of younger dwellings, but per capita use is usually greater.

* "A Study of Residential Water Use", Federal Housing Administration, U. S. Department of Housing and Urban Development, 1967.

** The patterns of winter use for various cities in the San Joaquin Valley indicate this assumption may not be valid in low rainfall temperature climatic zones.
(See Chapters III and IV)

The reduced dwelling requirements occur as the occupancy of homes changes from young families with children to older citizens whose families have matured and moved away. Per capita use increases under these circumstances because outside use remains essentially unchanged.

Conversely, increasing the size of the family will increase inside use but again will have little effect on the high fixed outside uses. The net result is a lowered per capita use.

This cause-and-effect relationship is borne out in an analysis made in the MEVA Corporation Report of the study by Dunn and Larson investigating water use in 208 households in an Illinois town. The analysis showed that per household use increases almost linearly with increase in family size (except for one person per household, where the use is less than would be extrapolated). Conversely, the per person use decreases as the number of persons per household increases (again, excluding the case of one person per household). The deviation for the case of one person per household may be due to the fact that in such households the occupant is away from home frequently or makes more frequent use of outside facilities, such as restaurants and laundromats.

Metering - In an unpublished study of metered versus unmetered water use in 12 San Joaquin Valley cities, the Department of Water Resources found that metered use averaged about 42 percent less than unmetered use. The results are presented below:

| San Joaquin Valley Cities | 1957 Data Metered Use | | | | | | Unmetered Use <u>1/</u> | | | | | |
|--------------------------------------|--------------------------|-------|-------|---------------|--------------------------|--------------|-------------------------|--------|--------|-------|--------------|---------|
| | Hanford | Arvin | Saner | Lindsay 2/ | East Bakers- field | Los Banos | Merced | Madera | Delano | Selma | Oil- Dale | Atwater |
| Average Daily Water Use (1,000 gals) | 3,814 | 519 | 960 | 1,605 | 1,725 | 975 | 6,446 | 4,696 | 3,837 | 2,440 | 4,486 | 3,000 |
| Population Served (1,000) | 15.3 | 6.0 | 8.2 | 5.5 | 11.6 | 5.8 | 23.4 | 14.0 | 11.1 | 6.8 | 16.6 | 6.8 |
| Gallons Per Capita Per Day (gpcd) | 249 | 102 | 117 | 292 | 149 | 165 | 276 | 335 | 346 | 358 | 270 | 439 |
| Weighted gpcd | 184 | | | | | | 316 | | | | | |

1/ Meters occasionally used on some large users.

2/ Includes consumption by large olive processing firm.

In the Federal Housing Administration's report on residential water use, the per-dwelling use of water in 10 metered and 7 unmetered areas in the western United States were compared. The comparison, presented below, shows that metered use was approximately 34 percent less than flat-rate use.

| Type of Use | Metered Use (10 Areas) | Flat-Rate Use (7 Areas) |
|------------------------|-----------------------------------|----------------------------|
| | gallons per day per dwelling unit | |
| Personal and Household | 247 | 236 |
| Outside | 186 | 420 |
| Leakage | <u>25</u> | <u>35</u> |
| TOTAL | 458 | 690 |

The 34 percent figure is very closely approximated by results of a study done by the staff of "Water and Sewage Works"*. The report stated that cities with more than 99 percent metering used approximately 32 percent less water than those with less than 50 percent metering. Langbein found at Ottawa, Ontario, that 100 percent metering lowered the daily per capita water consumption by 29 percent**.

The extent of metering in California varies greatly from area to area and even from city to city. In the San Francisco Bay and Los Angeles areas metering is practically universal and has been accepted by the consumers as part of their service. In many parts of the Central Valley and other outlying parts of California, however, much opposition exists to the use of meters. Even so, metering eventually is expected to become a common practice throughout the State.

Water agencies go to metering because they feel it is more equitable and businesslike to charge the consumer for the water actually delivered. Metering also results in better record keeping and stimulates water conservation, a subject of increasing emphasis in our society. Further and perhaps more important, metering results in reduced distribution costs. Initially, costs are higher because of costs in purchasing equipment, installing an accounting system, and reading the meters, but eventually this is offset by lower power and maintenance costs.

Sewering - Five of the 36 areas studied in the FHA residential water use study used septic tanks rather than sewers. Water use in these areas was found to be significantly less than in the sewered areas. The relationship developed in the 31 sewered areas between per dwelling water use and market value of the home was used as the basis for predicting water use in the septic tank areas. The results gave a 32 percent higher value than actual - the increase that would be expected with conversion from septic tanks to public sewers.

* Study published in edition of September 15, 1958, Page R-116

** Langbein, W. B., and Leopold, L. B., "A Primer on Water" USGS, 1960

In contrast to the sewered areas, water use in the septic tank areas was found to be unrelated to economic level but apparently directly related to population density. The reason for this relationship (and the smaller use) appears to center around the consumer's concern that his septic tank will require more frequent cleaning. The factors responsible for this relationship, however, are not known.

Miscellaneous - Increased use of water-using appliances can be expected to produce a significant increase in household and, to a lesser extent, per capita use*. This belief is supported by the following observations:

1. Addition of a garbage disposer introduces an entirely new water requirement.

2. Replacing hand methods of dish and clothes washing with automatic appliances increases these water uses by as much as 40 percent**.

3. Market studies by the electrical industry indicate that purchases of electrical appliances are increasing faster than net take-home income is increasing. Because a great many homes do not yet possess all of the water-using appliances (or even one), this trend can be expected to increase residential per capita use for some time into the future.

Air coolers have been relied upon for many years to increase comfort in homes in the Central Valley and desert areas where outside temperatures often approach or exceed 100 degrees Fahrenheit. The original evaporative water coolers are fast being replaced with refrigeration-type coolers. This lowers per capita use. New home units will probably be of the type which use the refrigeration principle.

The addition of a swimming pool to a lot is often assumed to have no appreciable effect on per capita use providing it displaces an equal amount of lawn. The assumption implies

* At least in the near future. Home recirculation systems are currently being investigated which, if introduced, would make these increases of little consequence.

** Horowitz, H., "A Study of the Effect of Automatic Sequence Clothes Washing Machines on Individual Sewage Disposal Systems", Natl. Acad. of Scis-Natl. Research Council Publ. 442, Building Research Institute (1956)

-Watson, K.S., "Water Requirements of Dishwashers and Food Waste Disposers", Jour. AWWA, May 1963

-Proctor & Gamble Co. (A national survey of water requirements for dishwashing)

-Ohio Agricultural Experiment Station (Bulletin of May 1956)

that evaporative losses from the pool are essentially the same as would occur if the pool area were in lawn and ornamentals. Because of splash losses and occasional pool draining for repairs and maintenance, actual use is believed to be somewhat higher.

The influence of water pressure on per capita use is not well understood. The study by Watson indicates that high pressures increase both rate of use and total quantity of water used by garbage disposers but has no effect on dishwater use. The conclusion reached in the Federal Housing Administration's report is that high pressures may increase the rate of use but that the time an appliance would be operated would be decreased and the total quantity would remain constant. This latter conclusion would appear to be the most reasonable until more substantive research is accomplished.

Water rationing during critically dry periods, such as restrictions on car washing or lawn sprinkling causes considerable reduction in the average per capita water use. Imposition of sprinkling restrictions in Detroit in 1952 resulted in more than a 17 percent decrease in total community use.* This decrease could have been much greater, but sprinkling was prohibited only between 10 a.m. and 9 p.m.

Normally, once restrictions are lifted, per capita use returns to prerestriction levels. An exception to this was noted in the study by Hanson and Hudson in which residents of a town in Illinois found they could get along with less water.

Other Urban-Related Factors

The other urban factors discussed in this section would only modify water use rates in a balanced community, where water use is dominated by the residential component. However, where high-water-using industries exist, the per capita rate might be influenced primarily by the industrial component.

Greenery - Generally the higher the proportion of vegetated area in a community the greater will be its per capita use. Although some older communities, such as the core area of Sacramento, have a high vegetation factor because of tree canopy, in most instances the higher proportion of greenery will be found in the newly constructed or expanding cities. This is due to larger home lot sizes, greater setback requirements from streets, and the more extensive landscaping of homes and all other categories of urban use than has been the custom in the past.

*"Effect of Sprinkling Restrictions", Heggie, G. D.
Jour. AWWA. March 1957.



Building regulations requiring homes to be set back farther from streets than in the past result in more greenery and greater outside use of water.



"Current city and county planning studies call for more extensive use of green-belt areas of public parks and quasi-public open spaces, much of which will be irrigated."



Current city and county planning studies call for more extensive use of green-belt areas of public parks and quasi-public open spaces, much of which will be irrigated. In Santa Clara County for example, this type of land use has increased by more than 1,500 acres in six years. Other counties are similarly providing for additional open space, which calls for irrigation and/or additional water use.

Kind of Community - A number of sizable communities around large population centers are essentially residential. They are within commuting distance of primarily industrial or financial centers. In such communities, unit water use values are set primarily by residential requirements and influenced by prevailing climate.

As communities enlarge, they tend to become more self-sufficient and acquire their own light manufacturing and service facilities. Most of the cities in the State fit into this category.

The development of a community into a highly industrialized area will usually increase per capita use appreciably. Within the San Francisco and Los Angeles urban complexes, there are several highly industrialized cities where water use is considerably higher than would normally be expected. The Department of Water Resources, in Bulletin No. 124, indicated that industries associated with food, lumber, paper, petroleum, chemicals, and clay and glass products have high water requirements with respect not only to total intake but also to unit values based on employees and plant area. In cities where any of these products are manufactured, per capita water use is higher than in adjacent cities of balanced land use.

A number of areas throughout the State have communities which can attribute their origin and growth to recreation. Other communities have become recreation-oriented after their initial development. In such areas, population fluctuates markedly from midweek to weekend and from season to season. Total water use is high during the vacation season, but diminishes at other times of the year. The kinds of water use in these recreational areas are much the same as in any urban area, except that there is almost no manufacturing use. Although the kinds of water use are essentially the same in both recreational and other urban areas, outside water use in recreational areas may be quite low because landscaping, when present, often consists of ornamentals and native plants that can thrive under natural rainfall conditions. Inside use of water frequently is greater than outside use but still less than inside use elsewhere because



"...Outside water use in recreational areas may be quite low because landscaping, when present, often consists of ornamentals and native plants that can thrive under natural rainfall conditions."



RECREATIONAL OUTSIDE WATER USE

fewer water-using appliances are present and/or because daytime occupancy of dwellings is less. The recent increase in construction of resort motels and larger residences at such areas will increase population densities and total water requirements. Per capita use should also increase because water use by recreational areas, while quite low during their early stages of development, increases during later stages because of greater outside use.

Another kind of community with unique water use characteristics is the agricultural-residential type. In most instances, such areas were originally high-income orchard lands. These orchards were developed into 1-to 5-acre home lots, essentially retaining the agricultural nature of the area. An example of this sort of development is the City of Carlsbad, a coastal community in Southern California, once an avocado orchard area. Because some income is derived from this crop, the trees are well watered and cared for. Per capita water use in such communities is much higher than in communities with otherwise similar characteristics.

Changes in Community Aspect - The areal relationship between various land use categories in an urban area changes constantly. For this reason, trends in water use are often difficult to explain. As cities enlarge and age, the older core areas often are converted to higher or more intensive types of use, either for profit-motivated economic reasons or because of urban renewal programs. Single-family dwellings give way to apartments, condominiums, and commercial establishments, while commercial and manufacturing establishments give way to similar but more intensive use. The net effect of such old-town "second-cycle growth" or "recycling", as it is called, is to increase population density and lower per capita use. Most major counties and many cities throughout the State now have master plans which propose orderly development of urban and open lands. The use of these plans in conjunction with unit water use values for the major urban categories should provide a useful basis for projecting future requirements of recycled areas and expected urban developments.

In a small city, the addition or removal of a single water-using entity of significant size can noticeably increase or decrease the city's demand for water. For example, the average daily per capita water use in Ukiah, exclusive of the water used by a company that manufactures press-board, is about 200 gallons. When the water use of this company is included, the per capita use is increased to about 560 gallons. Such an effect probably would not be felt in communities with populations exceeding 150,000.

Changing Industrial Water Requirements - Changing industrial water requirements in the major manufacturing centers of California are principally due to more efficient water use, changing industrial patterns, changes in industrial processes, and new industries. Industrial water requirements in Santa Clara County, for example, are markedly decreasing because of a change from food processing plants to light industries, such as electronics, precision instruments, research, and related groups.

Increased cost of water supply and disposal also can modify water use requirements. As water becomes more expensive and as stricter governmental controls increase, the costs of maintaining the quality of waste discharges, industrial users will be motivated to seek industrial processes using less water, to convert plant systems to permit greater reuse of water, or to develop their own water supplies. As an example of the influence of cost, recirculation has reached its highest refinement in areas where imported water, at higher than local water costs, constitutes a major portion of the supply. Data in Bulletin No. 124 by the Department indicates that about double the quantity of water now used by manufacturing industries would be required if water were not reused.

In contrast to the trend toward water conservation in certain industries, some manufacturers are using more water, such as for moving the product within the plant. Others are finding new water uses associated with new types of machinery.

Where present water requirements may be based on the relationship between number of employees and water use, automation can quickly invalidate such values. For example, automation in manufacturing has reduced the number of employees per unit of product, thus raising the unit water use values based on the employee. Employee unit water use values presented in Bulletin No. 124 may still be usable but probably will not remain valid much longer in those manufacturing groups which are rapidly acquiring automatic equipment.

Water Production and Use Measurements - Most of the water produced for use in the major metropolitan centers is measured accurately. Some of the smaller systems, however, are not equipped with meters and must rely on power records for estimating their use. Where water is obtained from wells with fluctuating ground water levels, such estimates can vary considerably from actual use unless consideration is given to attendant changes in power consumption necessary to maintain a given rate of flow.



WATER USED FOR TRANSPORTING
INDUSTRIAL PRODUCTS

"... some manufacturers are using more water, such as for moving the product within the plant." (Asparagus being transported by water through a dicer)

Illustration 6



EXAMPLE OF UNACCOUNTABLE WATER

One of the components of "unaccountable water" is the water tapped from an agency's water system for use on construction jobs.

Some agencies completely meter their customers but do not meter their source of supply. Thus, the total quantity of water introduced into the system can only be estimated. Throughout most of the State, this condition is rapidly being corrected and production records are soon expected to become universally available.

Water produced ranges from 4 to 15 percent higher than water delivered. A loss of 10 percent or less appears to be acceptable to most agencies even though occasionally, a system with a lower efficiency is encountered. The difference between production and delivery to customers is called "unaccountable water", or "loss in the system", and may be caused by one or more of the following factors:

- Flushing of sewers and hydrants.
- Free water delivery to "public facilities".
- Back-flushing of filter equipment.
- Hydrant tapping for use of water on construction jobs.
- Defective or slow recording meters.
- Leakage in the system
- Storage evaporation.
- Fire fighting and other unmeasured use.
- Unreported data for some meters in system.

These losses can be determined, isolated, and possibly reduced only by accurate measurement of both production and delivery. Where total production values were not available, they were obtained by increasing total delivery values by 10 percent.

Unreported Water Use - In computing unit water use for a community, use of agency data alone will result consistently in low values, since more water is produced and used than is recorded. Most of this unrecorded water originates from private wells in manufacturing plants, in commercial enterprises, and on residential property. An example of the quantity of such supplemental water sources is presented below for four cities in the San Joaquin Valley*.

AVERAGE PER CAPITA WATER USE FOR SEVERAL CITIES

| City | Year | From Public Water Supplies | From Known Private Supplies |
|-------------|------|----------------------------|-----------------------------|
| Bakersfield | 1959 | 297 gallons/day | 10 gallons/day |
| Fresno | 1956 | 317 gallons/day | 102 gallons/day |
| Hanford | 1959 | 249 gallons/day | 66 gallons/day |
| Visalia | 1959 | 261 gallons/day | 50 gallons/day |

* Data obtained from an unpublished Department report titled, "Urban Water Use in Five San Joaquin Valley Cities", March 1960

Normally, private water producers for residential and commercial uses follow the same general patterns of use as their counterparts served by water agencies. If they are located outside a water agency service area, the omission of their water use will have a negligible effect on per capita values. If they occur within such a boundary, they can increase per capita use. Unfortunately, no data is available on the number of such producers or the quantity of water they produce. Since few residential users can produce water as economically as it can be purchased, the additive effect of this component on per capita use is considered negligible. On the other hand, some commercial establishments have found it more economical to develop their own water. The addition of high-water-using commercial producers such as laundries or car washes could result in an increased per capita use. The influence of this condition would be felt more strongly in smaller communities. The importance of the contribution of these private producers will be investigated in future studies.



High-water-using commercial establishments producing their own water can increase per capita use in small communities.

Generally, the private industry-produced increment of unreported water is the largest. Its addition to annual agency-produced water can more than double the per capita use. Obtaining an estimate of the quantity of this source of water is difficult because many producers fail to keep records or to provide reasonable estimates. Nevertheless, much useful data were collected in a 1957-59 statewide survey of industrial water use, reported in Bulletin No. 124. For example, the report indicates that 1,630 manufacturing establishments within an area including the north half of the Central Coastal, all of the San Francisco Bay, and the southern panhandle of the North Coastal Hydrographic Areas used 148,700 acre-feet of fresh water, of which 80,900 acre-feet, or 54 percent, was produced by private company systems. Although, no absolute percentage values can be given of the contribution of private industry-produced fresh water to total use, per capita values representing most of the industrial use are reported in Chapter III by county and hydrographic areas.

No data are available to estimate quantities of water which are developed privately by commercial enterprises or at urban and suburban residences. On a statewide basis, the contribution of these private sources is believed to be small. At the local level, however, the contribution could be appreciable, especially where water tables are high and where pumping water is cheaper than purchasing it.

Population Served - Determining accurately the population served by a water agency is a task as important and as difficult as determining accurately the amount of water produced. Boundaries of water service areas seldom coincide with the boundaries of cities or census areas. A water agency occasionally serves only a portion of a city or serves customers beyond the city limits. In a larger city, the remaining area may be served by one or more small agencies. Early computations of per capita use under these conditions were frequently unrealistically low because the water served by the smaller agencies was not included in the computations although the population served by the smaller agencies was included. To overcome these problems and to obtain more realistic population values, various techniques were used in this report. The techniques used are discussed in Appendix B.

Miscellaneous - Other factors which can be expected to influence M&I water use are worn flow meters and inadequate distribution systems. These conditions would tend to lower per capita use values. An increase in the ratio of population to number of high-water-using industries tends to decrease the unit values of water use.

CHAPTER III. URBAN PER CAPITA WATER USE

In this chapter are presented the results of an inventory and analysis of per capita water use in the major population centers of the State.

Considerations in Using Results

The effective use of the per capita values presented herein requires familiarity with the background material in Chapter I and an understanding of the various factors affecting M&I water use discussed in Chapter II. The user will also find the items discussed below of some additional value in clarifying the extent to which the per capita values can be used.

Data Accuracy

In developing per capita water use values for this report, most of the water production measurements and estimates used were made by personnel of water agencies and private manufacturing establishments. As a result, it has not been possible to verify the water production values or even to evaluate the physical state of individual water systems; i.e., their line losses, the accuracy of their meters, the care used in recording the information, etc. The population component, on the other hand, was frequently estimated by personnel of the Department. Because estimates were obtained through interpolation, extrapolation, or the use of a factor, the accuracy of the results could be no better than the base data on which they were estimated and the techniques required to compute them. As a result, the overall degree of reliability maintained in developing the urban per capita water use values is subject to great variation. However, where there have been clear indications of questionable data, such data has either been strengthened or discarded.

Data from commercial water agencies on population and water use reported to the State Public Utilities Commission are generally quite reliable. However, frequent checks among the numerous public water service agencies disclosed that water use estimates were not always made with the same level of accuracy or detail.

Average Values

Prior to developing five-year average urban per capita water use values, consideration was given to developing long-term averages. A number of factors discouraged this approach.

To use the classical method of statistics whereby extrapolation or estimation of future values can be made as far into the future as records extended into the past, historical annual per capita water use would have to change uniformly with time.

Analyses of unit water use data covering the past 50 years reveals these values to be extremely erratic with respect to time and fail to disclose any definite trend which can be assumed to be repeated in the future with a high degree of reliability. Known factors abetting these erratic variations over the past 50 years include two great wars, two smaller wars, a depression, widespread use of automobiles and planes, mass westward migration of population and an ever-increasingly affluent society. While similar historic events may recur within the next 50 years, just how, when, and to what degree is very nebulous. Time has not permitted additional detailed analyses of causes for individual annual variations nor has it permitted analyses of the relationships between the major factors involved in developing unit water use values.

Not only have long-term trends been interrupted, they have been stopped or reversed in certain cases. This has occurred in manufacturing, where technology has found ways of conserving and reusing water or has reduced the dependency of a particular process on water. In many urban areas, population densities have increased and greenery has decreased. The result is lower per capita water use.

Because current trends are often so dissimilar from long-term trends, it is believed to be rather hazardous to use data that go very far back in time. Planners need values which will represent future use. Because of this need and the greater availability of recent data, the most current five years of record was selected as the base period for developing urban unit water use values. Wherever possible, the period 1961-65 was used.

In some instances, it was either impractical or impossible to develop a complete five-year record for each city studied. In these cases, all the data covering any portion of the period 1958-1967 were used in the report. The fact that the same five-year period was not always used in developing the averages is not believed to be significant. The reason is that an adequate number of common years exists in each average to limit variation.

In a few cities, annual values were available for more years than were monthly values. In these cases an average was developed for the annual values separately from the monthly values. Examples where two averages are shown are for the city of San Bruno, Table 3b, page 42. Except for Crescent City in the North Coastal Hydrographic Area, at least two years of record were available for each city.

As can be seen from the table below, data were generally less abundant and less complete in low-density areas of the State.

Relationship Between Population Distribution and Extent of Sampling

| Hydrographic Area | Average 1960-65 Population | Percent of State Total | Percent of Population Sampled |
|----------------------------|----------------------------------|---------------------------|-------------------------------------|
| South Lahontan | 195,000 | 1.1 | 4 |
| Colorado River Basin | 199,000 | 1.1 | 15 |
| North Coastal | 253,000 | 1.4 | 43 |
| San Joaquin River Basin | 374,000 | 2.2 | 26 |
| Delta-Central Sierra Basin | 378,500 | 2.2 | 28 |
| Central Coastal | 640,000 | 3.7 | 43 |
| Tulare Lake Basin | 884,500 | 5.1 | 42 |
| Sacramento River Basin | 1,030,500 | 6.0 | 35 |
| San Francisco Bay | 3,820,000 | 22.3 | 79 |
| South Coastal | 9,413,000 | 54.8 | 52 |

Periods of Peak and Low Water Use

Examination of yearly data in Appendix C shows that periods of peak and low water use are not always in the same month. Also, there is not always a definite upward trend to peak use or a downward trend from peak to low use. Interruption of such trends may be due to rainfall, unusual temperature conditions, water-system flushing, once-a-year special uses of water such as for food processing, or a number of other reasons. Whenever possible, attempts have been made to determine the reasons for such interruptions. In many instances, a brief examination of the data reveals no apparent reason. An in-depth examination of data to explain such variables has not yet been attempted. However, this will be considered in future work.

Results and Discussion

Five-year averages of daily per capita water use by month and year were developed from water-agency data, and three-year averages of daily per capita use of fresh and brackish water by year were developed from data of manufacturing establishments producing their own water.

Agency-Produced Water

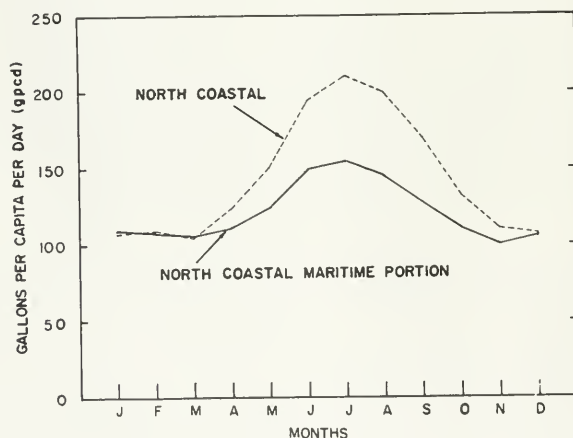
Daily per capita water use was averaged by month and year, by hydrographic areas, by counties, and by cities.

Hydrographic Areas - Per capita water use within the hydrographic areas is presented in Table 1 and charted in Figure 6. They were obtained by weighting the average per capita values of each city within the hydrographic area according to its population.

As can be seen, the North Coastal HA* has the lowest per capita water use (excluding the water used by the pulp industry)**, while the Tulare Lake Basin and San Joaquin River Basin areas have the highest. The maritime portion of the North Coastal HA (north of Fort Bragg) shows very little fluctuation from winter to summer, an indication that very little water other than rainfall is needed to sustain vegetative growth. These results are shown on Figure 7.

Figure 7

COMPARISON OF PER CAPITA WATER USE IN TWO AREAS OF THE NORTH COASTAL HYDROGRAPHIC AREA



* Hydrographic Area

** In 1966, the water used by the pulp industry amounted to 66,100 acre-feet, an amount of water equal to 538 gpcd when related to the average population served during 1965 in the seven cities of the hydrographic area examined.

TABLE 1

AVERAGE MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY-PRODUCED WATER
(1961-1965) $\frac{1}{2}$

Hydrographic Areas

| Hydrographic Area | | Average Estimated Population of Area | Average Estimated Population Served | % of Total Pop. Served | Unit | Average Daily Water Use | | | | | | | | | | | | Total Annually |
|-------------------|----------------------------|--------------------------------------|-------------------------------------|------------------------|------------|-------------------------|-------------|-------------|-------------|-------------|-------------|------------|-------------|-------------|---------|--|--|----------------|
| | | | | | | Monthly (gpcd) / | | | | | | | | | | | | |
| Code | Name | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | gpcd | afcyd / | | | |
| NC | North Coastal | 107 6.3 | 109 5.8 | 104 6.2 | 124 7.1 | 151 8.9 | 194 11.1 | 211 12.5 | 199 11.8 | 170 9.7 | 133 7.9 | 110 6.3 | 107 6.3 | 143 .150 | | | | |
| SP | San Francisco Bay | 110 6.3 | 113 5.9 | 117 6.7 | 134 7.5 | 161 9.3 | 186 10.3 | 196 11.2 | 195 11.2 | 181 10.1 | 151 8.7 | 118 6.6 | 108 6.2 | 146 .160 | | | | |
| CC | Central Coastal | 107 6.2 | 104 5.4 | 101 5.8 | 134 7.8 | 161 9.3 | 186 11.8 | 205 12.5 | 203 12.5 | 187 11.7 | 158 10.4 | 117 6.1 | 101 5.8 | 148 .155 | | | | |
| SC | South Coastal | 127 6.5 | 134 6.1 | 135 6.9 | 154 7.6 | 181 9.2 | 193 9.5 | 224 11.4 | 222 11.3 | 191 10.4 | 176 9.4 | 139 8.9 | 127 6.5 | 167 .187 | | | | |
| SB | Sacramento River Basin | 141 4.5 | 147 4.3 | 168 5.4 | 214 6.7 | 282 9.1 | 390 12.2 | 468 15.1 | 428 13.8 | 359 12.2 | 252 8.1 | 162 5.0 | 145 4.7 | 253 .294 | | | | |
| DC | Delta-Central Sierra Basin | 109 4.0 | 115 3.9 | 121 4.5 | 152 5.5 | 205 7.6 | 278 10.0 | 344 13.4 | 361 13.8 | 394 14.2 | 288 10.7 | 214 7.7 | 129 4.8 | 227 .254 | | | | |
| SJ | San Joaquin River Basin | 126 3.3 | 142 3.4 | 177 4.7 | 251 6.5 | 384 10.3 | 510 13.2 | 598 16.0 | 568 15.2 | 442 11.4 | 312 8.3 | 163 4.2 | 130 3.5 | 317 .355 | | | | |
| TB | Tulare Lake Basin | 127 3.4 | 154 3.7 | 190 5.1 | 282 7.4 | 385 10.4 | 521 13.6 | 602 16.2 | 548 14.8 | 397 10.4 | 271 7.3 | 153 4.3 | 129 3.5 | 314 .352 | | | | |
| SL | South Lahontan | 132 3.8 | 148 3.8 | 183 5.2 | 254 7.0 | 312 8.9 | 422 11.6 | 487 13.9 | 450 14.5 | 321 9.2 | 209 5.8 | 136 3.9 | 298 .334 | | | | | |
| CD | Colorado Desert | 151 4.6 | 187 5.2 | 205 6.3 | 295 7.6 | 393 9.3 | 406 12.1 | 448 13.7 | 414 12.7 | 333 9.9 | 253 7.8 | 199 5.9 | 152 5.0 | 277 .310 | | | | |
| SUMMARY | | 123 6.1 | 127 5.7 | 136 6.5 | 155 7.4 | 189 9.3 | 216 10.3 | 244 12.0 | 238 11.7 | 208 9.9 | 177 8.7 | 134 6.4 | 121 6.0 | 172 .193 | | | | |

1/ Base period. Variations in period and years of record exist for individual cities. Refer to Table 3.

2/ Based on Table 2. Population of area values for portions of divided counties determined by Department of Water Resources. They include only those counties for which agency-produced data were obtained.

3/ All values weighted by populations of counties served.

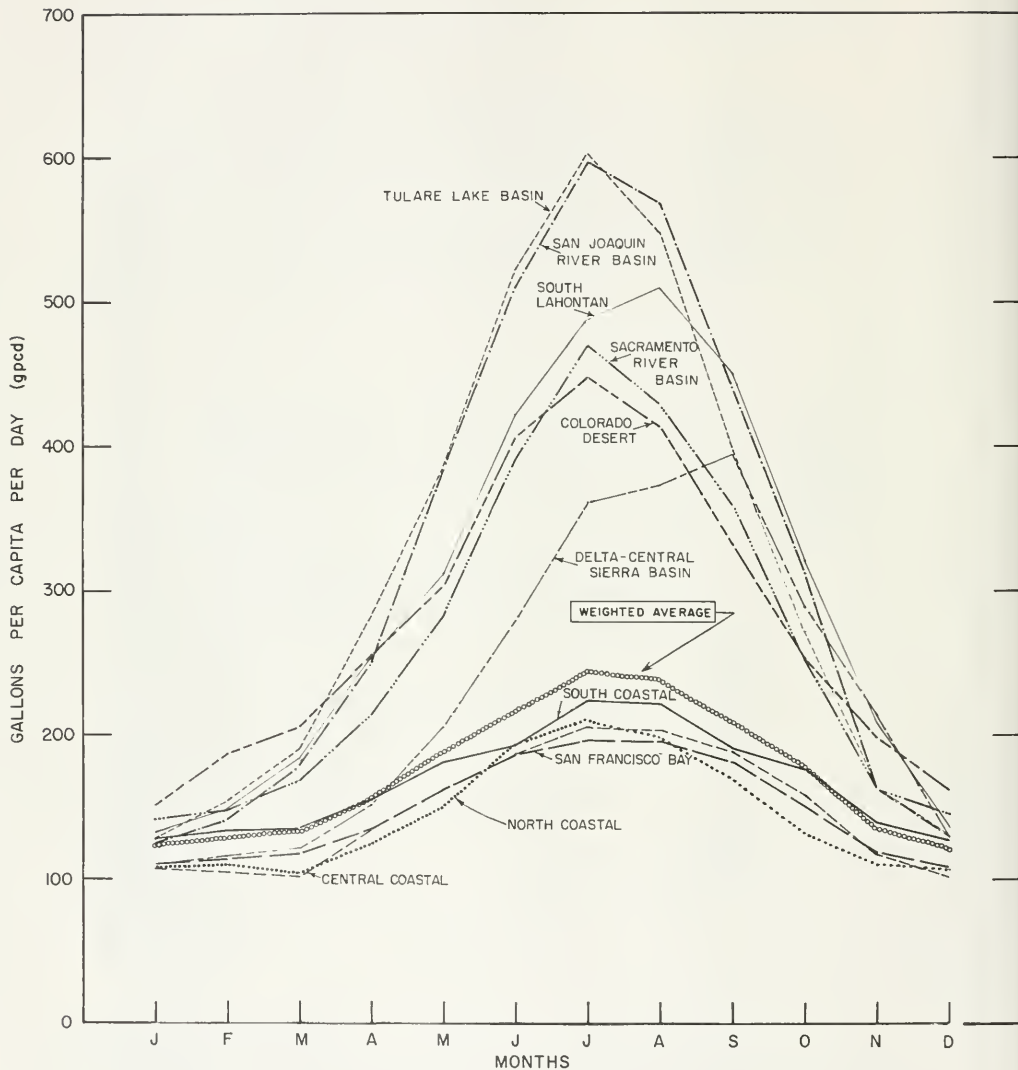
4/ afpcy-acre feet per capita per year.

5/ Does not include water used by the pulp industry in the Eureka-Arcata area. In 1966, the water used by this industry amounted to 66,100 acre-feet, an amount of water equal to 536 gpcd when related to the average population served during 1965 in the seven cities of the hydrographic area examined.

6/ % Annual = monthly gpcd x days in month x 100

Σ monthly gpcd x days in month

AVERAGE MONTHLY PER CAPITA WATER USE
AGENCY PRODUCED FRESH WATER
HYDROGRAPHIC AREAS



Although the occurrence of the lowest values in the North Coastal area is not surprising, the occurrence of the highest values in the San Joaquin River Basin is. From the higher temperatures and lower rainfall in the Colorado Desert Area and South Lahontan HA's, it would be expected that the highest value would occur there. Although the reason for this departure from expected results is not fully known, probably less external water is used in these two areas because of the small lawn and garden areas and often sparse vegetation.

Figure 6 also shows that per capita water use in the Central Coastal Area is similar to the use in the San Francisco Bay and North Coastal areas and only slightly lower than in the South Coastal area. The reason for the similarity appears to be related to the uniform climatic conditions that prevail along the coast.

Especially noticeable on the graph is the great contrast between values for the coastal areas and values for the desert and central valley areas. If it were not for the number of inland coastal valleys included in the analyses for the coastal areas, the contrast would have been even more pronounced, as exemplified by the curves for the total coastal portion of the North Coastal Area and the maritime portion of the North Coastal Area.

The high per capita use in the Colorado Desert Area during the winter is principally due to mild temperature and low rainfall in the low desert areas where the sampled cities were located, which sustain year-round leisure-recreational activities and require continued watering of lawns and ornamental shrubbery.

The weighted statewide monthly use, depicted by the wide line, shows that the higher-populated areas with their lower unit water use have more influence on the statewide pattern than do the lower-populated, higher-unit-water-use areas. However, the latter areas will play an increasingly important role in shaping the future statewide pattern of use as the major coastal population centers reach saturation and urban expansion accelerates inland.

Counties - Table 2 shows per capita urban water use values by county. The counties of Alpine, Calaveras, Colusa, Inyo, Lassen, Mariposa, Modoc, Mono, Nevada, Plumas, Sierra, Siskiyou, Trinity, Tuolumne, and Yolo are not included because data were not obtained for any communities within their boundaries. The value for Humboldt County does not include the water supplied by Humboldt Bay Municipal Water District for use by the pulp industry in the Eureka-Arcata area. In 1966, this was 66,100 acre-feet and, when related to the average population of cities examined in the county, equals 1,224 gpcd.

The monthly urban per capita water use values were determined from data on water supplied only through water agencies. The

TABLE 2
AVERAGE MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY-PRODUCED WATER
(1961-1965)^{1/2}
County

| County ^{2/} | Average Estimated Population of County ^{3/} | Average Estimated Population Served ^{4/} | Percent of Total Population Served | Average Daily Water Use | | | | | | | | | | | | TOTAL | |
|------------------------|---|--|---|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|------------------|
| | | | | Monthly (gpcd) | | | | | | | | | | | | | |
| | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | Annually gpcd |
| Alameda | 970,400 | 939,362 ^{5/} | 97 | 119 | 128 | 127 | 148 | 174 | 197 | 207 | 208 | 193 | 163 | 128 | 117 | 158 | .177 |
| Amador | 10,800 | 3,343 | 31 | 208 | 250 | 209 | 208 | 271 | 318 | 389 | 423 | 471 | 393 | 348 | 305 | 316 | .354 |
| Butte | 90,100 | 44,491 | 49 | 125 | 127 | 150 | 256 | 352 | 588 | 694 | 660 | 483 | 259 | 145 | 122 | 330 | .370 |
| Contra Costa | 459,300 | 294,058 | 64 | 119 | 122 | 127 | 149 | 178 | 204 | 215 | 223 | 211 | 175 | 131 | 120 | 162 | .181 |
| Del Norte | 18,050 | 5,000 | 28 | 165 | 143 | 106 | 133 | 151 | 158 | 150 | 157 | 147 | 114 | 87 | 147 | 138 | .155 |
| Fresno | 387,050 | 173,876 | 45 | 123 | 147 | 178 | 288 | 385 | 525 | 619 | 566 | 415 | 280 | 172 | 132 | 319 | .357 |
| Glenn | 18,000 | 4,825 | 27 | 120 | 125 | 135 | 223 | 303 | 524 | 555 | 480 | 363 | 224 | 136 | 118 | 272 | .305 |
| Humboldt ^{1/} | 105,050 | 48,200 | 46 | 107 | 108 | 109 | 113 | 125 | 151 | 158 | 147 | 128 | 115 | 103 | 105 | 122 | .137 |
| Imperial | 74,550 | 18,640 | 25 | 145 | 176 | 193 | 230 | 290 | 354 | 382 | 347 | 293 | 241 | 172 | 146 | 247 | .277 |
| Kern | 311,300 | 131,977 | 42 | 139 | 173 | 214 | 293 | 401 | 534 | 609 | 557 | 399 | 281 | 165 | 133 | 325 | .364 |
| Kings | 58,500 | 18,112 | 31 | 111 | 133 | 178 | 246 | 352 | 457 | 503 | 455 | 326 | 234 | 134 | 108 | 270 | .302 |
| Lake | 15,500 | 5,174 ^{5/} | 33 | 90 | 90 | 102 | 131 | 195 | 279 | 322 | 294 | 231 | 178 | 108 | 94 | 151 | .169 |
| Los Angeles | 6,453,550 | 3,544,596 | 55 | 139 | 140 | 141 | 159 | 186 | 196 | 228 | 225 | 194 | 179 | 143 | 133 | 172 | .193 |
| Madera | 42,400 | 15,300 | 36 | 149 | 174 | 214 | 265 | 453 | 582 | 681 | 625 | 450 | 312 | 166 | 143 | 351 | .393 |
| Marin | 167,700 | 161,522 | 96 | 97 | 101 | 105 | 127 | 166 | 203 | 216 | 209 | 187 | 156 | 114 | 97 | 148 | .166 |
| Mendocino | 51,150 | 15,163 | 30 | 100 | 101 | 103 | 128 | 170 | 262 | 298 | 273 | 217 | 146 | 105 | 104 | 167 | .187 |
| Merced | 98,750 | 39,200 | 40 | 114 | 127 | 161 | 227 | 355 | 478 | 565 | 514 | 371 | 264 | 144 | 117 | 287 | .321 |
| Monterey | 209,950 | 128,035 | 61 | 88 | 86 | 88 | 108 | 138 | 166 | 171 | 166 | 156 | 131 | 101 | 83 | 123 | .138 |
| Napa | 70,800 | 42,820 | 60 | 127 | 130 | 135 | 135 | 189 | 232 | 248 | 255 | 236 | 193 | 131 | 121 | 178 | .199 |
| Orange | 928,100 | 316,300 | 34 | 132 | 140 | 140 | 168 | 203 | 224 | 252 | 257 | 221 | 199 | 148 | 132 | 185 | .207 |
| Placer | 60,900 | 11,723 | 19 | 151 | 153 | 137 | 154 | 203 | 316 | 489 | 658 | 515 | 374 | 241 | 166 | 287 | .322 |
| Riverside | 359,700 | 121,300 | 34 | 149 | 163 | 165 | 217 | 262 | 317 | 375 | 354 | 287 | 229 | 188 | 151 | 238 | .267 |
| Sacramento | 557,350 | 261,900 | 47 | 144 | 151 | 169 | 211 | 279 | 357 | 425 | 380 | 333 | 249 | 162 | 149 | 251 | .281 |
| San Benito | 16,300 | 7,182 ^{5/} | 44 | 98 | 97 | 106 | 124 | 148 | 172 | 194 | 196 | 232 | 203 | 98 | 94 | 148 | .166 |
| San Bernardino | 570,400 | 104,479 | 18 | 133 | 144 | 141 | 189 | 236 | 288 | 358 | 344 | 275 | 226 | 156 | 131 | 219 | .245 |
| San Diego | 1,115,104 | 793,179 | 71 | 98 | 101 | 101 | 116 | 136 | 143 | 161 | 165 | 147 | 138 | 104 | 97 | 186 | .141 |
| San Francisco | 745,000 | 745,000 | 100 | 114 | 114 | 116 | 123 | 131 | 141 | 137 | 135 | 134 | 125 | 115 | 110 | 125 | .141 |
| San Joaquin | 261,800 | 88,869 | 34 | 109 | 113 | 121 | 153 | 203 | 279 | 368 | 380 | 410 | 294 | 218 | 125 | 230 | .258 |
| San Luis Obispo | 90,750 | 30,609 | 34 | 122 | 131 | 132 | 169 | 212 | 247 | 278 | 270 | 236 | 196 | 145 | 123 | 188 | .211 |
| San Mateo | 485,650 | 208,631 ^{5/} | 43 | 86 | 92 | 92 | 109 | 126 | 156 | 164 | 161 | 154 | 128 | 106 | 89 | 124 | .138 |
| Santa Barbara | 206,000 | 64,560 | 31 | 136 | 130 | 146 | 161 | 186 | 191 | 222 | 225 | 198 | 170 | 127 | 122 | 168 | .188 |
| Santa Clara | 768,050 | 613,567 ^{5/} | 80 | 97 | 103 | 112 | 128 | 177 | 213 | 237 | 231 | 209 | 160 | 106 | 96 | 157 | .175 |
| Santa Cruz | 94,500 | 38,631 | 41 | 112 | 103 | 111 | 144 | 144 | 184 | 209 | 228 | 217 | 189 | 137 | 115 | 157 | .176 |
| Shasta | 67,100 | 15,315 | 23 | 133 | 135 | 152 | 186 | 243 | 381 | 485 | 428 | 330 | 224 | 150 | 134 | 250 | .280 |
| Solano | 147,200 | 12,519 | 8 | 84 | 91 | 94 | 131 | 201 | 262 | 303 | 308 | 264 | 220 | 154 | 111 | 185 | .207 |
| Sonoma | 163,450 | 45,188 | 28 | 102 | 108 | 100 | 133 | 178 | 225 | 248 | 240 | 206 | 155 | 124 | 105 | 160 | .179 |
| Stanislaus | 166,650 | 42,300 | 25 | 128 | 143 | 179 | 268 | 385 | 513 | 598 | 597 | 506 | 355 | 179 | 138 | 232 | .372 |
| Sutter | 36,200 | 2,276 | 6 | 89 | 85 | 100 | 176 | 283 | 403 | 462 | 409 | 312 | 176 | 131 | 98 | 227 | .254 |
| Tehama | 26,800 | 3,071 | 12 | 187 | 171 | 184 | 227 | 258 | 427 | 489 | 468 | 356 | 275 | 203 | 201 | 287 | .321 |
| Tulare | 177,800 | 43,716 | 24 | 111 | 128 | 168 | 236 | 350 | 491 | 555 | 488 | 348 | 220 | 138 | 110 | 278 | .311 |
| Ventura | 250,900 | 47,850 | 19 | 121 | 117 | 112 | 150 | 173 | 170 | 173 | 200 | 239 | 183 | 138 | 117 | 158 | .177 |
| Yuba | 38,650 | 9,936 | 26 | 162 | 168 | 160 | 232 | 280 | 428 | 519 | 477 | 357 | 261 | 185 | 166 | 283 | .317 |
| SUMMARY | 16,947,450 | 9,201,800 | 55 | 123 | 127 | 136 | 155 | 189 | 216 | 244 | 238 | 208 | 177 | 134 | 121 | 172 | .193 |

^{1/} Base period. Variations in period and years of record exist for individual cities. Refer to Table 3.

^{2/} Includes only those counties for which agency produced data were obtained.

^{3/} Population of County--average of 1960 and 1965 DWR estimates; Population Served--sum of average population estimates for individual cities.

^{4/} All values weighted by populations of cities served.

^{5/} Annual values for --Alameda : Lake : San Benito : San Mateo : Santa Clara : counties were based on the following populations: 923,583 : 4,774 : 6,651 : 206,502 : 613,386 :

The populations differ because in certain communities more years of data were available for determining average annual values than average monthly values.

^{6/} afpcy - acre feet per capita per year.

^{7/} Does not include water used by pulp industry in the Eureka-Arcata area. In 1966, the amount of water used by this industry amounted to 66,100 acre-feet, an amount of water equal to 1,224 gpcd when related to the average population of cities examined in the county.

addition of fresh and brackish water produced by manufacturing concerns would influence the unit use value immensely and would create patterns of use very different from those shown on Figure 6 for some areas of the State, especially for the North Coastal Area. Monthly data from these other sources were not obtained for this report, but collecting such data is a future goal.

Cities - The cities studied are discussed below by hydrographic area. Where possible, unusual monthly patterns of water use and unusual maintenance and operation practices are described. The locations of the cities are shown on Figure 3. Yearly data for these cities are presented in Appendix C.

(North Coastal HA) - The average monthly and annual per capita values for the seven cities sampled in the North Coastal Hydrographic Area are summarized in Table 3a.

TABLE 3a
AVERAGE MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER

NORTH COASTAL
Hydrographic Area

| County City | Agency * (Name and Type) | Period of Record | Yrs. of Rec. | Avg. Annual Water Into System (million gals.) | Average Estimated Population Served | Highest Monthly Use (gpcd) | Average Daily Water Use Monthly (gpcd) | | | | | | | | | | | | Total | |
|----------------|---|------------------------|--------------------|--|--|-------------------------------------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|-------|
| | | | | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | gpcd | afpcy |
| | | | | | | | | | | | | | | | | | | | | |
| DELAWARE | | | | | | | | | | | | | | | | | | | | |
| Crescent City | - M.W.D. | 1966 | 1 | 232 | 5,000 | - | 165 | 143 | 106 | 133 | 151 | 158 | 150 | 157 | 147 | 112 | 87 | 147 | ** | ** |
| KENTUCKY | | | | | | | | | | | | | | | | | | | | |
| Aranta | - M.W.D. | 1964-66 | 3 | 350 | 9,300 | 130 | 92 | 90 | 94 | 97 | 116 | 115 | 118 | 114 | 111 | 103 | 96 | 91 | 103 | 115 |
| Burke | - M.W.D. & Runkle C.S.D. | 1963-66 | 4 | 1,766 | 37,800 | 187 | 112 | 113 | 114 | 118 | 129 | 161 | 168 | 155 | 132 | 119 | 106 | 110 | 128 | 143 |
| Garberville | Garberville Water Company, Inc. (C.W.C.) | 1962-64 | 3 | 39 | 1,100 | 167 | 70 | 77 | 68 | 77 | 84 | 130 | 158 | 151 | 120 | 86 | 75 | 67 | 97 | 109 |
| MICHIGAN | | | | | | | | | | | | | | | | | | | | |
| Port Hope | - M.W.D. | 1961-65 | 5 | 198 | 5,300 | 157 | 82 | 85 | 84 | 90 | 106 | 136 | 143 | 131 | 115 | 92 | 83 | 83 | 102 | 114 |
| Ukiah | - M.W.D. | 1961-65 | 5 | 726 | 9,843 | 402 | 110 | 110 | 113 | 149 | 205 | 330 | 381 | 350 | 272 | 175 | 117 | 115 | 202 | 226 |
| SONORA | | | | | | | | | | | | | | | | | | | | |
| Santa Rosa | - M.W.D. | 1961-65 | 5 | 2,403 | 41,411 | 265 | 103 | 109 | 99 | 134 | 174 | 223 | 247 | 237 | 204 | 152 | 123 | 106 | 159 | 178 |

* The following abbreviations are used throughout Table 3 to denote the type of agency:

- C.S.D. - Community Services District
- C.W.C. - Commercial Water Company
- C.W.D. - County Water District
- C.W.W.D. - County Waterworks District
- I.D. - Irrigation District
- M.U.D. - Municipal Utility District
- M.W.D. - Municipal Water Department
- U.M.W.C. - Unincorporated Mutual Water Company

** In 1966, average daily water use was 138 gpc and total annual use was 0.154 afpc.

A considerable portion of the North Coastal area is outside the coastal environment, as shown in Figure 3. However, approximately 90 percent of the area's total population inhabit the coast. The remaining ten percent live primarily in Scott and Shasta Valleys of Siskiyou County. Crescent City and Eureka, which have a sizable lumber and wood products industry, have higher per capita water use than the other coastal cities*. In Garberville and Fort Bragg monthly per capita water use increases sharply in June and remains high until sometime during September. The sharp increase results from adding the water used by the recreation-seeking transient population to the resident population. This method of arriving at per capita water use was necessary because firm data on transient population was not available for this report. This method is used in other areas influenced by recreational use.

Four of the five northernmost cities not only have low per capita water use, but their winter use is nearly constant. This relatively stable condition is due, in large measure, to the moderately cool moist climate requiring very little external use. Another factor damping seasonal fluctuations is the high, constant monthly use of water by the lumber and wood products industry.

Compared with the five cities discussed above, water use in Ukiah and Santa Rosa is quite high. Climate explains most of the difference, since the latter communities are more inland.

(San Francisco Bay HA) - As in the North Coastal HA, per capita water use in the San Francisco Bay HA is influenced by the coastal environment. Average monthly and/or annual unit urban water use values for the 26 cities and 5 multiple city and community service agencies sampled in San Francisco Bay area are summarized in Table 3b.

The weighted average per capita values developed for the area were based on data from the total East Bay Municipal Utility District and 23 other agencies. These 24 entities comprise about 17 percent of the State's total population and approximately 79 percent of the total population within the area. The East Bay Municipal Utility District, alone, serves almost 27 percent of the area's total population.

Per capita use averages higher than in the North Coastal HA for two principal reasons: The San Francisco Bay HA has more communities in coastal valleys, which use more water per capita than cities immediately along the coast; and the area has many high-water-using industries, such as food

* Pulp industry water use is not included in these values or those for the other cities. Refer to discussion on Page 34.

TABLE 3b
AVERAGE MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

| County City | Agency* (Name and Type) | Period of Record | Yrs. of Rec- ord | Avg. Annual Water Into System (million gals.) | Average Estimated Population Served | Highest Monthly Use (gpcd) | Average Daily Water Use | | | | | | | | | | | | Total | |
|--------------------|------------------------------------|---------------------|------------------------|--|--|-------------------------------------|-------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------------|--------------|
| | | | | | | | Monthly (gpcd) | | | | | | | | | | | | Annually gpcd | efpy |
| | | | | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| ALAMEDA | | | | | | | | | | | | | | | | | | | | |
| Alameda | East Bay M.U.D. | 1961-65 | 5 | 2,918 | 67,173 | - | - | - | - | - | - | - | - | - | - | - | - | - | 119 | .133 |
| Berkeley | East Bay M.U.D. | 1961-65 | 5 | 5,870 | 114,800 | - | - | - | - | - | - | - | - | - | - | - | - | - | 140 | .157 |
| Livermore | Cal. Water Service Co. (C.W.C.) | 1961-65 | 5 | 1,110 | 22,517 | 243 | 77 | 83 | 85 | 123 | 154 | 202 | 227 | 203 | 164 | 126 | 92 | 73 | 135 | .151 |
| Oakland | East Bay M.U.D. | 1961-65 | 5 | 18,059 | 375,819 | - | - | - | - | - | - | - | - | - | - | - | - | - | 132 | .149 |
| Pleasanton | Pleasanton Township (C.W.D.) | 1964-66 | 3 | 477 | 6,658 | 286 | 95 | 104 | 119 | 155 | 211 | 241 | 271 | 267 | 237 | 213 | 125 | 118 | 180 | .202 |
| San Leandro | East Bay M.U.D. | 1961-65 | 5 | 3,814 | 67,517 | - | - | - | - | - | - | - | - | - | - | - | - | - | 155 | .171 |
| San Ramon Village | Valley C.S.D. | 1962-65 | 4 | 318 | 7,810 | 207 | 66 | 73 | 67 | 90 | 129 | 157 | 180 | 161 | 142 | 117 | 74 | 66 | 110 | .123 |
| S. E. Bay Area | Alameda C.W.D. | 1962-66 | 5 | 4,355 | 90,398 | - | - | - | - | - | - | - | - | - | - | - | - | - | 132 | .147 |
| S. E. Bay Area | Alameda C.W.D. | 1961-65 | 1 | 5,581 | 106,182 | 207 | 95 | 98 | 111 | 155 | 191 | 207 | 190 | 191 | 170 | 144 | 95 | 86 | 144 | .163 |
| CONTRA COSTA | | | | | | | | | | | | | | | | | | | | |
| Antioch | - M.W.D. | 1962-65 | 4 | 1,374 | 20,554 | 349 | 90 | 96 | 106 | 154 | 219 | 254 | 241 | 252 | 330 | 229 | 104 | 94 | 184 | .206 |
| Martinez | - M.W.D. | 1962-66 | 5 | 924 | 15,832 | 277 | 91 | 77 | 103 | 147 | 195 | 223 | 219 | 275 | 263 | 218 | 113 | 108 | 172 | .193 |
| Pittsburg | - M.W.D. | 1961-65 | 5 | 976 | 19,952 | 220 | 90 | 88 | 98 | 120 | 145 | 175 | 201 | 196 | 166 | 135 | 105 | 89 | 134 | .150 |
| Richmond | East Bay M.U.D. | 1961-65 | 5 | 10,187 | 76,201 | - | - | - | - | - | - | - | - | - | - | - | - | - | 367 | .411 |
| Walnut Creek | East Bay M.U.D. | 1961-65 | 5 | 893 | 13,079 | - | - | - | - | - | - | - | - | - | - | - | - | - | 187 | .209 |
| MARIN | | | | | | | | | | | | | | | | | | | | |
| North Marin Cities | North Marin C.W.D. | 1961-65 | 5 | 984 | 20,522 | 265 | 66 | 72 | 74 | 103 | 143 | 182 | 202 | 201 | 164 | 122 | 82 | 72 | 124 | .139 |
| South Marin Cities | Marin M.W.D. | 1964-65 | 5 | 7,720 | 151,000 | 232 | 101 | 105 | 110 | 131 | 169 | 206 | 218 | 210 | 190 | 149 | 111 | 101 | 150 | .168 |
| MENDOCINO | | | | | | | | | | | | | | | | | | | | |
| Ukiah | - M.W.D. | 1964-65 | 5 | 784 | 9,844 | 502 | 110 | 110 | 111 | 140 | 205 | 110 | 381 | 350 | 272 | 175 | 117 | 115 | 202 | .226 |
| NAPA | | | | | | | | | | | | | | | | | | | | |
| Calistoga | - M.W.D. | 1961-65 | 5 | 151 | 1,914 | 590 | 158 | 174 | 203 | 183 | 194 | 256 | 305 | 287 | 241 | 182 | 156 | 150 | 216 | .242 |
| Napa | - M.W.D. | 1964-65 | 2 | 2,628 | 50,000 | 210 | 126 | 128 | 127 | 131 | 188 | 211 | 245 | 254 | 236 | 193 | 130 | 120 | 176 | .197 |
| SAN FRANCISCO | | | | | | | | | | | | | | | | | | | | |
| San Francisco | - M.W.D. | 1961-65 1964-65 | 5 5 | 13,261 13,261 | 185,000 185,000 | 111 114 | 114 114 | 114 116 | 121 121 | 131 131 | 141 137 | 135 135 | 134 125 | 125 115 | 110 110 | 125 125 | 140 140 | 140 140 | 125 125 | .140 .140 |
| SANTA CLARA | | | | | | | | | | | | | | | | | | | | |
| Mountain View | - M.W.D. | 1961-65 | 5 | 1,000 | 50,000 | 180 | 91 | 94 | 101 | 121 | 152 | 174 | 185 | 179 | 162 | 136 | 108 | 97 | 134 | .150 |
| Palo Alto | - M.W.D. | 1961-65 | 5 | 4,348 | 57,548 | 309 | 127 | 148 | 142 | 170 | 205 | 262 | 302 | 294 | 286 | 232 | 176 | 131 | 207 | .232 |
| San Jose | San Jose Water Works (C.W.C.) | 1961-65 | 3 | 24,235 | 428,364 | 159 | 94 | 99 | 109 | 124 | 178 | 214 | 238 | 211 | 208 | 156 | 99 | 92 | 155 | .174 |
| Sunnyvale | - M.W.D. | 1961-65 | 3 | 4,008 | 78,425 | 215 | 92 | 99 | 109 | 117 | 160 | 188 | 202 | 206 | 182 | 139 | 93 | 91 | 140 | .157 |

* Refer to Table 3a for abbreviations (page 39).

SAN FRANCISCO BAY (cont'd)
Hydrographic Area

TABLE 3b
AVERAGE MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER

CITIES

| County City | Agency* (Name and Type) | Period of Record | Yr. of Rec. | Avg. Annual Water Into System (million gals.) | Average Estimated Population Served | Highest Monthly Use (gpcd) | Average Daily Water Use Monthly (gpcd) | | | | | | | | | | | | Total | |
|--|------------------------------------|------------------------|-------------------|--|--|-------------------------------------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------------------|-----------------|
| | | | | | | | | | | | | | | | | | | | Annually gpcd | Annual efpcr |
| | | | | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| SAN MATEO | | | | | | | | | | | | | | | | | | | | |
| Belmont | Belmont C.W.D. | 1961-65 | 5 | 897 | 20,300 | 197 | 89 | 95 | 99 | 117 | 138 | 168 | 159 | 152 | 142 | 111 | 93 | 88 | 121 | .136 |
| Half Moon Bay Cities | Coastside C.W.D. | 1962-65 | 4 | 159 | 4,774 | 117 | 72 | 86 | 68 | 88 | 94 | 90 | 96 | 106 | 108 | 102 | 102 | 76 | 91 | .102 |
| Pacific | North Coast C.W.D. | 1961-65 | 5 | 883 | 26,573 | 148 | 65 | 73 | 68 | 74 | 80 | 106 | 126 | 118 | 115 | 101 | 90 | 72 | 91 | .102 |
| Redwood City | - M.W.D. | 1961-65 | 5 | 2,692 | 50,168 | 177 | 82 | 94 | 90 | 105 | 128 | 159 | 167 | 163 | 163 | 133 | 103 | 88 | 123 | .138 |
| San Bruno | - M.W.D. | 1961-65 | 5 | 1,533 | 32,759 | - | - | - | - | - | - | - | - | - | - | - | - | - | 128 | .143 |
| San Bruno | - M.W.D. | 1964-65 | 2 | 1,490 | 34,888 | 146 | 91 | 92 | 94 | 106 | 110 | 136 | 139 | 146 | 145 | 136 | 120 | 94 | 117 | .131 |
| San Mateo | Cal. Water Service Co. (C.W.C.) | 1961-65 | 5 | 1,597 | 73,908 | 204 | 95 | 98 | 100 | 125 | 147 | 184 | 195 | 185 | 172 | 136 | 110 | 95 | 137 | .153 |
| SONOMA | | | | | | | | | | | | | | | | | | | | |
| Sebastopol | - M.W.D. | 1961-65 - 1966-67 | 3 | 238 | 3,777 | 300 | 97 | 102 | 106 | 124 | 226 | 242 | 260 | 273 | 229 | 183 | 137 | 98 | 173 | .194 |
| Eastern San Francisco Bay M.U.D. System | East Bay M.U.D. | 1961-65 | 5 | 61,140 | 1,034,000 | 222 | 124 | 127 | 131 | 148 | 173 | 196 | 209 | 211 | 196 | 167 | 134 | 123 | 162 | .181 |

* Refer to Table 3a for abbreviations (page 39).

processing, chemical, and petroleum industries. The high-water-using industries probably account for the high overall per capita use within the service area of the East Bay Municipal Utility District, which serves many such establishments.

Lower rainfall and higher temperatures also contribute to higher use because of greater outside use. Higher temperatures also increase internal use during the summer, particularly in the eastern portion of the study area and in the southern portions of the Santa Clara Valley, where a few evaporative coolers are still used. Also, the residential areas typically are being built on larger lots with more extensive shrubbery and lawns than in the residential areas in the North Coastal Area, where the peak summer use varies considerably among the communities. Although the scope of the studies has not permitted a thorough investigation of the reasons for different peaking months, some information is available on a few of the communities.

In the city of Antioch, the occurrence of the peak use in September is caused by a single cannery, which processes tomatoes during that month and uses between 30 and 40 percent of the city's water. In the city of Pittsburg, just four miles to the west, peaking occurs in July and in the city of Martinez, 15 miles further west, the peaking occurs in August. This variation is due to different industrial needs and the greater influence of residential outside water use. In the city of Calistoga, the peak use usually occurs in July, but may occur in March. This happens because, when the water department flushes out the system lines, it does so in March. This was done in two of the last five years.

(Central Coastal HA) - The Central Coastal HA contains approximately 4 percent of the State's total population. Of this, approximately 43 percent was included in the cities sampled. Average monthly and annual values for the six cities and two multiple city and community service agencies sampled in the Central Coastal Area are presented in Table 3c.

The two multiple city water agencies, California Water Service Company and California American Water Company, gave service to a total of seven cities for which data are included.

In the Central Coastal HA, per capita water use of the inland cities of Kings City, Hollister, Paso Robles, and Gilroy is higher during the summer growing season months than those cities along the coast. During the winter, these cities have lower temperatures than cities bordering the coast and are more subject to foggy weather, which tends to reduce outside water use.

CENTRAL COASTAL
Hydrographic AreaTABLE 3c
AVERAGE MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER

| Hydrographic Area | | | | CITIES | | | | | | | | | | | | | | | | | | Total | |
|------------------------|---|------------------------|-------------------|--|--|-------------------------------------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------|-------|--|-------|--|
| County City | Agency* (Name and Type) | Period of Record | Ys. of Rec. | Avg. Annual Water Into System (million gals.) | Average Estimated Population Served | Highest Monthly Use (gpcd) | Average Daily Water Use Monthly (gpcd) | | | | | | | | | | | | Annually | | | | |
| | | | | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | gpcd | ofpcy | | | |
| CITIES | | | | | | | | | | | | | | | | | | | | | | | |
| MONTEREY | Cal. American Water Co. (C.W.C.) | 1959-63 | 5 | 363 | 6,995 | - | 102 | - | 108 | - | 152 | - | 184 | - | 180 | - | 126 | - | 142 | .159 | | | |
| Carmel | | | | | | | | | | | | | | | | | | | | | | | |
| King City | Cal. Water Service Co. (C.W.C.) | 1962-65 | 4 | 271 | 3,003 | 421 | 124 | 140 | 156 | 213 | 271 | 339 | 361 | 379 | 361 | 278 | 196 | 153 | 247 | .277 | | | |
| Monterey | Cal. American Water Co. (C.W.C.) | 1959-63 | 5 | 900 | 21,809 | - | 86 | - | 82 | - | 111 | - | 141 | - | 149 | - | 111 | - | 113 | .127 | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| Monterey Bay Cities | Cal. American Water Co. (C.W.C.) | 1961-65 | 5 | 3,261 | 89,500 | 159 | 82 | 77 | 81 | 102 | 126 | 148 | 151 | 145 | 133 | 113 | 83 | 70 | 109 | .122 | | | |
| Pacific Grove | Cal. American Water Co. (C.W.C.) | 1959-63 | 5 | 452 | 12,258 | - | 74 | - | 70 | - | 100 | - | 135 | - | 133 | - | 96 | - | 101 | .114 | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| Salinas | P. O. & E (1961) - Cal. Water Service Co. (C.W.C.) | 1963-65 | 3 | 1,932 | 35,532 | 234 | 100 | 103 | 101 | 116 | 156 | 195 | 205 | 199 | 198 | 165 | 137 | 109 | 149 | .167 | | | |
| Seaside | Cal. American Water Co. (C.W.C.) | 1959-63 | 5 | 169 | 10,855 | - | 68 | - | 72 | - | 100 | - | 116 | - | 102 | - | 75 | - | 88 | .099 | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| SAN BENITO | | | | | | | | | | | | | | | | | | | | | | | |
| Hollister | - M.W.D. | ** | 5 | 352 | 6,651 | - | - | - | - | - | - | - | - | - | - | - | - | - | 148 | .166 | | | |
| Hollister | - M.W.D. | 1964-65 | 2 | 385 | 7,182 | 261 | 98 | 97 | 106 | 124 | 148 | 172 | 194 | 196 | 232 | 203 | 98 | 94 | 147 | .164 | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| SAN JUAN OBISPO | | | | | | | | | | | | | | | | | | | | | | | |
| Paso Robles | - M.W.D. | 1961-65 | 5 | 676 | 6,809 | 494 | 131 | 150 | 160 | 230 | 316 | 405 | 472 | 453 | 376 | 268 | 168 | 139 | 272 | .305 | | | |
| San Juan Obispo | - M.W.D. | 1961-65 | 5 | 1,425 | 23,800 | 240 | 120 | 125 | 124 | 152 | 182 | 202 | 222 | 218 | 196 | 175 | 139 | 119 | 164 | .184 | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| SANTA BARBARA | | | | | | | | | | | | | | | | | | | | | | | |
| Santa Barbara | - M.W.D. | 1961-65 | 5 | 3,959 | 64,560 | 245 | 136 | 130 | 146 | 161 | 186 | 191 | 222 | 225 | 198 | 170 | 127 | 122 | 166 | .183 | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| SANTA CLARA | | | | | | | | | | | | | | | | | | | | | | | |
| Gilroy | - M.W.D. | *** | 5 | 543 | 8,848 | - | - | - | - | - | - | - | - | - | - | - | - | - | 168 | .188 | | | |
| Gilroy | - M.W.D. | 1963-65 | 3 | 570 | 9,030 | 309 | 93 | 100 | 146 | 133 | 209 | 264 | 301 | 260 | 217 | 169 | 98 | 82 | 173 | .194 | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| SANTA CRUZ | | | | | | | | | | | | | | | | | | | | | | | |
| Santa Cruz | - M.W.D. | 1961-65 | 5 | 2,214 | 35,631 | 259 | 112 | 103 | 111 | 144 | 144 | 184 | 209 | 223 | 217 | 189 | 137 | 115 | 157 | .176 | | | |

* Refer to Table 3a for abbreviations (page 39).

** 1960-61 through 1962-63 and 1964 through 1965. Six months of record missing in last half of 1963.

*** 1960-61 through 1961-62 and 1963 through 1965. Six months of record missing in last half of 1962.

Table 3c discloses that per capita water use in Monterey County cities varies considerably. For example, King City, approximately 50 miles south of Salinas, shows an annual per capita use of 247 gpcd, which is more than twice the annual value for Monterey Bay city residents. Climate in this case is the major factor for the higher King City value.

A slight difference has also been noted between the cities of Monterey and Carmel. The community of Carmel, with its larger estates, has low population densities and high external use of water, all of which add up to higher per capita water use.

Although only three years of records were available, Salinas, with a per capita use of 149 gpcd, appears to have the highest unit use of the coastal cities in Monterey County. This is partly due to a greater industrial base than in the other cities and partly due to high external water use.

Comparison of water use rates in Salinas, King City, and Paso Robles indicates that per capita use increases away from the coast. Paso Robles, about 100 miles south of Salinas, has a per capita use of 272 gpcd, which is primarily due to climate. The city has hot, dry summers and requires more water for external watering than the other two communities. Since Paso Robles has little industry, the high use is primarily a reflection of this application and illustrates the influence that residential watering can have on a community's per capita use.

An example of how industries influence the use of water is shown in the data for Hollister. The month in which peak use normally occurs in most communities in the Central Coastal HA is July. In Hollister, the peak use occurs in September when two canneries process tomatoes. In addition, spinach is washed and processed this month.

In the southern portion of the hydrographic area, water use values for San Luis Obispo and Santa Barbara further illustrate that per capita water use is quite constant along the coast. The average annual per capita water use for Santa Barbara, 168 gallons per day, is only four gallons per day higher than for San Luis Obispo.

In the Monterey Bay area, the coastal city with the highest per capita use is Santa Cruz, with 157 gpcd annually. This is surprising considering that it receives more rainfall and has lower temperatures than coastal cities farther south. A primary reason for the higher use is the large number of people attracted to the city's beach area on weekends and during the summer. Higher per capita use results because the water used by this group is added to that used by the resident population and the total is then converted to per capita use using only the resident population. Recreational use of the other communities, while large, is not as seasonal or as intense. This fact is substantiated by the highest average monthly use of 228 gpcd, a value considerably higher than the peak use in the other communities. Also accounting for some of the higher use is the large number of small family units of retired citizens living there.

(South Coastal HA) - The average monthly and annual values for the area's 18 cities and the California American Water Company serving three communities in the vicinity of Chula Vista, reported in Table 3d, account for the water used by 4,900,000 of the 9,400,000, or 52 percent, of the people

living in the South Coastal Hydrographic Area. The area contains approximately 55 percent of the State's population and even though it extends inland for a considerable distance, only three cities - Pomona, Riverside and San Bernardino - are far enough inland to be essentially free of the coastal influence. The three inland cities account for six percent of the total population sampled and would therefore exert little influence on the use in the South Coastal Hydrographic Area. As shown by Figure 3, the average water use throughout the year is consistently higher, by a small amount, in the South Coastal HA than in any of the other coastal areas.

In the northern part of the State, differences in per capita water use of cities are primarily due to climatic differences, extent of metering, industrial use, or extent of recreational use. The same reasons for differences also apply in the southern portion of the State, except for metering, because virtually all water use in southern California is metered. In many of the southern cities, however, these reasons are often not the only primary ones. Differences are also apt to be due to population density and such economic level factors as median incomes, market value of homes, size of lots and the use of water-using appliances.

In the Los Angeles metropolitan area, per capita water use for Burbank and Glendale, if based on climate alone, should have similar values. Burbank's higher use is associated with an extensive industrial complex, including aircraft manufacturing and a major motion picture-television complex with its large transient labor population. Helping to keep Glendale's per capita use low is the recycling of older residential sections into multiple-residential areas. This kind of development results in relatively less per capita water use than single-residential type because of the increased population density and the usually reduced water-using yard area. For these reasons, the unit urban water use in Burbank is much higher than in Glendale.

In Pasadena and Beverly Hills, the high water use is due to the low population density associated with the extensive areas of estate-type residences and high median income, two closely associated factors.

Census data indicates that the city of Fullerton in Orange County has a higher average annual per capita water use value than the neighboring cities of Anaheim and Santa Ana because of Fullerton's lower gross urban population density and higher per capita income. Similarly, Anaheim has a higher per capita water use than Santa Ana due to its higher median income and lower population density.

Four of the entities sampled in San Diego County - Chula Vista area cities and the cities of San Diego, Oceanside, and Escondido - have low per capita use because of low per capita income, high population densities, and a relatively high percentage of low-water-using residential development.

Carlsbad, the other city sampled in San Diego County, uses water at a rate twice that of its neighboring city of Oceanside just three miles north along the coast (303 gpcd versus 148). Water deliveries in Carlsbad are made to homes with $\frac{1}{2}$ to 2 acres of irrigated citrus and avocado trees. This agricultural-residential type of development is well established in the community and can be expected to continue for some time.

(Sacramento River Basin HA) - This area, which includes nearly all of the Sacramento River drainage system, contains 6 percent of the State's population. Average monthly and annual values for 14 cities, representing approximately 35 percent of the 1,000,000 people in the hydrographic area, are presented in Table 3e.

The average annual per capita use shown in Figure 3 is a little less than double the use along the coast. The mean annual value is lower than those of almost all of the communities because the City of Sacramento, accounting for more than two-thirds of the sampled population, has an annual per capita use value lower than all other cities in the valley floor and foothill areas, except Liveoak.

The water use of the small communities around Clear Lake is primarily recreation-oriented. These communities have relatively high densities, a small proportion of the land area devoted to lawns and ornamental shrubs, and a high influx of recreation seekers during the summer. In Lakeport, for example, the population more than doubles between Memorial Day and Labor Day. The same method was used to determine per capita water use in Lakeport, Kelseyville, and Clearlake Highlands as was used in Santa Cruz in the Central Coastal Hydrographic Area.

The highest annual per capita use in the hydrographic area is for the community of Paradise. Originally, this community was an orchard area; however, in the past 15 years it has been converted rapidly to a low-density residential community while still retaining much of its agricultural characteristics. One of the attractions of the area has been the chance to own a home with a small orchard. As a result, a considerable portion of the water used by the community still goes to this purpose. There is no way of separating this use from water used for strictly residential purposes. However, if the present trend of conversion continues, the density of the community will increase and the agricultural use of water will diminish, with the resulting lowering of

TABLE 3e
AVERAGE MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

| County City | Agency* (Name and Type) | Period of Record | Yrs. of Rec. | Avg. Annual Water Into System million gals. | Average Estimated Population Served | Highest Monthly Use (gpcd) | Average Daily Water Use Monthly (gpcd) | | | | | | | | | | | | Total | |
|----------------|--|------------------------|--------------------|--|--|-------------------------------------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------------------|--------|
| | | | | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annually gpcd | Agency |
| NUTTE | Cal. Water Service Co. (C.W.S.C.) | 1960-64 | 5 | 3,777 | 39,797 | 803 | 112 | 118 | 146 | 269 | 374 | 641 | 753 | 664 | 457 | 256 | 136 | 108 | 136 | .376 |
| | | | | | | | | | | | | | | | | | | | | |
| | - M.W.D. | 1960-64 | 5 | 328 | 3,484 | 543 | 127 | 118 | 136 | 216 | 305 | 440 | 518 | 439 | 328 | 205 | 131 | 129 | 258 | .289 |
| | | | | | | | | | | | | | | | | | | | | |
| | Cal. Water Service Co. (C.W.S.C.) | 1961-65 | 5 | 1,251 | 10,200 | 740 | 164 | 158 | 165 | 229 | 301 | 478 | 577 | 722 | 613 | 288 | 176 | 164 | 136 | .376 |
| Paradise | Paradise I. D. | 1961-65 | 5 | 1,552 | 13,900 | 1,246 | - | 74 | - | 97 | - | 315 | - | 693 | - | 540 | - | 114 | 306 | .343 |
| | | | | | | | | | | | | | | | | | | | | |
| CLON | Cal. Water Service Co. (C.W.S.C.) | 1960-64 | 5 | 76 | 721 | 313 | 118 | 123 | 142 | 246 | 347 | 524 | 582 | 517 | 377 | 250 | 137 | 109 | 289 | .324 |
| | | | | | | | | | | | | | | | | | | | | |
| | Cal. Water Service Co. (C.W.S.C.) | 1960-64 | 5 | 403 | 4,104 | 558 | 120 | 125 | 134 | 219 | 295 | 479 | 550 | 474 | 360 | 280 | 136 | 120 | 269 | .301 |
| LAKE | Clearlake Highlands (U.M.W.C.) | 1961-65 | 5 | 63 | 1,255 | - | - | - | - | - | - | - | - | - | - | - | - | - | 125 | .140 |
| | | | | | | | | | | | | | | | | | | | | |
| | Highland Water Co. (H.W.C.) | 1964-65 | 2 | 78 | 1,553 | 274 | 72 | 74 | 82 | 105 | 148 | 196 | 265 | 212 | 184 | 138 | 83 | 84 | 137 | .153 |
| Kelseyville | Kelseyville County Waterworks #1 (C.W.W.D.) | 1961-65 | 5 | 30 | 919 | - | - | - | - | - | - | - | - | - | - | - | - | - | 88 | .099 |
| | Kelseyville County Waterworks #3 (C.W.W.D.) | 1964-65 | 2 | 31 | 919 | 183 | 36 | 46 | 70 | 74 | 124 | 174 | 172 | 145 | 110 | 67 | 50 | 44 | 93 | .104 |
| Lakeport | - M.W.D. | 1961-65 | 5 | 176 | 2,570 | - | - | - | - | - | - | - | - | - | - | - | - | - | 188 | .211 |
| | | | | | | | | | | | | | | | | | | | | |
| Lakeport | - M.W.D. | 1964-65 | 2 | 224 | 2,702 | 416 | 118 | 114 | 124 | 165 | 246 | 362 | 405 | 392 | 300 | 238 | 142 | 116 | 227 | .254 |
| | | | | | | | | | | | | | | | | | | | | |
| PLACER | Placer County Football Cities | 1960-64 | 5 | 1,228 | 11,721 | 580 | 151 | 157 | 137 | 154 | 203 | 316 | 489 | 548 | 515 | 374 | 241 | 166 | 287 | .322 |
| | | | | | | | | | | | | | | | | | | | | |
| SACRAMENTO | Sacramento | 1961-65 | 5 | 23,994 | 261,900 | 434 | 144 | 151 | 169 | 211 | 279 | 357 | 425 | 380 | 333 | 249 | 162 | 149 | 251 | .281 |
| | | | | | | | | | | | | | | | | | | | | |
| SHASTA | Redding | 1961-65 | 5 | 1,356 | 15,315 | 566 | 133 | 135 | 152 | 186 | 243 | 381 | 485 | 428 | 330 | 224 | 150 | 134 | 250 | .280 |
| | | | | | | | | | | | | | | | | | | | | |
| SUTTER | Live Oak | 1958-62 | 5 | 189 | 2,276 | 501 | 89 | 85 | 100 | 176 | 283 | 403 | 462 | 409 | 312 | 176 | 131 | 98 | 227 | .254 |
| | | | | | | | | | | | | | | | | | | | | |
| TERRAMA | Corning | 1959-60/4 (1964-66) | 5 | 322 | 3,071 | 697 | 187 | 171 | 154 | 227 | 258 | 427 | 489 | 468 | 356 | 275 | 203 | 201 | 287 | .321 |
| | | | | | | | | | | | | | | | | | | | | |
| YUBA | Marysville | 1961-65 | 5 | 1,262 | 5,316 | 520 | 162 | 168 | 150 | 232 | 280 | 428 | 519 | 477 | 357 | 261 | 165 | 166 | 283 | .316 |
| | | | | | | | | | | | | | | | | | | | | |

* Refer to Table 3a for abbreviations (page 39)

per capita water use to approach that of other residential communities in the hydrographic area.

Rather high per capita use in Chico and Oroville may also reflect a similar transition from agricultural use to urban use, at least on the periphery of the two cities. Also contributing to Chico's high water use are the numerous large landscaped homesites with high external water requirements that are found within the city and the transient college student population.

The annual per capita water use of 250 gpcd for the community of Redding is rather modest compared with the rates in Chico, Oroville, and Paradise of 336, 336, and 306 gpcd, respectively. This is due in part to the greater population density; many residential areas are composed of small homes on small lots.

(Delta-Central Sierra Basin HA)* - This is the smallest of the 11 hydrographic areas of California, containing a little more than two percent of the State's population. Water use of 28 percent of this population, or approximately 104,000 people, was sampled. Average monthly and annual urban water use values for one city and two water service entities serving Stockton and four smaller foothill communities are shown in Table 3f.

DELTA-CENTRAL SIERRA BASIN
Hydrographic Area

TABLE 3f
AVERAGE MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER

| County City | Agency* (Name and Type) | Period of Record | Yrs. of Rec. | Avg. Annual Water Into System million gals. | Average Estimated Population Served | Highest Monthly Use (gpcd) | Average Daily Water Use | | | | | | | | | | | | Total | |
|--|------------------------------------|------------------------|--------------------|--|--|-------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------|------|
| | | | | | | | Monthly (gpcd) | | | | | | | | | | | | Annually | |
| | | | | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | gpcd | afpy |
| AMADOR Amador County Foothill Cities | Pacific Gas & Electric (C.W.C.) | 1960-64 | 5 | 386 | 3,343 | 527 | 208 | 250 | 209 | 208 | 271 | 318 | 389 | 423 | 471 | 393 | 348 | 305 | 316 | .354 |
| SAN JOAQUIN Stockton | Cal. Water Service Co. (C.W.C.) | 1961-65 | 5 | 7,461 | 88,869 | 421 | 309 | 313 | 321 | 353 | 203 | 279 | 368 | 380 | 410 | 294 | 218 | 125 | 230 | .261 |
| SOLANO Vacaville | M.W.D. | 1960-69 1964-69 | 5 | 845 | 12,319 | 329 | 84 | 91 | 94 | 133 | 201 | 262 | 303 | 308 | 264 | 220 | 154 | 111 | 185 | .207 |

* Refer to Table 3a for abbreviations (page 39).

One valley floor community, Vacaville, actually falls in the Sacramento River Basin, but has been included in this hydrographic area because, geographically and climatically, it is more closely tied to it. The four foothill communities

* This area makes up the northernmost segment of the San Joaquin River Basin Hydrographic Area as defined in Bulletin No. 2. See "Study Boundaries", Chapter I, for a discussion of this separation.

and the City of Stockton have their highest water use in September. While it is not known why the water use peaks at this time in Amador County foothill cities, it follows the same pattern as do the smaller foothill communities in the Sacramento River Basin. The September peak for Stockton is due to high use by the canneries processing tomatoes.

The average annual use in the Amador County foothill cities is rather high compared with valley floor use, which is in agreement with results obtained for foothill communities in the Sacramento River Basin. A possible explanation for this is that the foothill communities use more water in irrigating garden plots and small home orchards.

The relatively low average annual per capita use in the City of Vacaville is apparently due to small lot areas, which cause a slightly higher population density than in most valley communities.

(San Joaquin River Basin HA) - The San Joaquin River Basin is comparable to the Delta-Central Sierra Basin in population and also contains a little more than 2 percent of the State's population, 26 percent of which was sampled. In terms of water use, the comparison ends here. The San Joaquin River Basin has a mean annual gpcd of 316, while the Delta-Central Sierra Basin has 227. Average monthly and annual unit water use values for the six communities sampled are presented in Table 3g.

TABLE 3g
AVERAGE MONTHLY AND ANNUAL URSAN UNIT WATER USE
AGENCY PRODUCED WATER

SAN JOAQUIN RIVER BASIN
Hydrographic Area

CITIES

| County City | Agency (Name and Type) | Period of Record | Yrs. of Rec. | Avg. Annual Water Into System (million gals.) | Average Estimated Population Served | Highest Monthly Use (gpcd) | Average Daily Water Use Monthly (gpcd) | | | | | | | | | | | | Total | |
|----------------|----------------------------------|------------------|--------------|---|-------------------------------------|----------------------------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|-------|
| | | | | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | gpcd | afpcy |
| MADERA | | | | | | | | | | | | | | | | | | | | |
| Madera | - M.W.D. | 1963-65 | 3 | 1,960 | 15,300 | 710 | 149 | 174 | 214 | 265 | 453 | 582 | 691 | 625 | 450 | 312 | 166 | 143 | 351 | .393 |
| MERCED | | | | | | | | | | | | | | | | | | | | |
| Castle Gardens | U. S. Air Force | 1961-65 | 5 | 328 | 3,025 | 703 | 81 | 114 | 203 | 295 | 402 | 533 | 594 | 514 | 390 | 236 | 115 | 85 | 297 | .333 |
| Los Banos | - M.W.D. | 1965-66 | 2 | 756 | 10,554 | 389 | 94 | 112 | 134 | 170 | 248 | 260 | 336 | 352 | 262 | 224 | 116 | 100 | 202 | .226 |
| Merced | - M.W.D. | 1961-65 | 5 | 3,027 | 26,000 | 650 | 124 | 135 | 164 | 252 | 334 | 543 | 649 | 591 | 420 | 282 | 159 | 128 | 319 | .357 |
| STANISLAUS | | | | | | | | | | | | | | | | | | | | |
| Ceres | Ceres Water works, Inc. (M.W.D.) | 1961-65 | 5 | 313 | 4,583 | 319 | 87 | 98 | 103 | 150 | 212 | 297 | 316 | 316 | 265 | 180 | 129 | 87 | 187 | .209 |
| Modesto | - M.W.D. | 1961-65 | 5 | 4,811 | 37,660 | 682 | 133 | 149 | 189 | 282 | 406 | 540 | 613 | 632 | 535 | 377 | 185 | 144 | 350 | .392 |

* Refer to Table 3a for abbreviations (page 39).

The data show there is nearly a two-fold variation from the lowest mean annual value of 187 gpcd for the city of Ceres to the highest values of 351 and 350 gpcd in Madera and Modesto, respectively. The low value in Ceres and in

Los Banos (202 gpcd) appear to be associated with the higher percentage of metering in the two cities than in the others. The percent of metered water agency deliveries in the six communities is shown below.

San Joaquin River Basin

Percent of Total Deliveries Metered (1965)

| | |
|----------------|-------------|
| Los Banos | 98 |
| Ceres | 71 |
| Modesto | 16 |
| Madera | less than 1 |
| Merced | 0 |
| Castle Gardens | 0 |

These values, when compared with corresponding per capita values shown in Table 3g, indicate that metering has a strong bearing on per capita use. However, this is but one factor affecting water use, so departures from a direct relationship between metering and unit water use would be expected. For example, Los Banos, with 98 percent of its deliveries metered, has a higher per capita use than Ceres, with 71 percent. This is attributable to a significant amount of industry at Los Banos, while Ceres is almost exclusively residential.

Water use in the residential communities of Castle Gardens and Ceres would be expected to have similar unit water use values and patterns, but they are quite different. Castle Gardens, a United States Air Force housing center, has only residential water use. Ceres has some commercial and public water use, but these exert little, if any, influence on the average values. However, Castle Gardens has an average annual water use of 297 gpcd, while Ceres has one of only 170 gpcd. Castle Gardens has a three-month peak use period (June, July, and August) with an average peak value for these months of 547 gpcd. Ceres discloses a four-month peak period (June, July, August, and September) with an average of 271 gpcd. The peak month of water use at Castle Gardens is July, with an average value of 594 gpcd, which is twice the average annual water use. In Ceres, July and August are the peak months, each with an average value of 287 gpcd, which is only 1.7 times the average annual value.

Probable explanations for the large difference in metering between the two communities are metering and cost. Castle Gardens has no metering and homeowners are not charged for water, while Ceres is 71 percent metered and users are charged for water. Metering generally reduces water use because the user becomes acutely aware of the cost-quantity relationship and begins to use water more efficiently.

(Tulare Lake Basin HA) - This hydrographic area contains a little more than 5 percent of the State's population. The average monthly and annual per capita water use values for the seven cities presented in Table 3h are representative of approximately 42 percent of this population, or around 368,000 people.

TABLE 3h
AVERAGE MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES
TULARE LAKE BASIN
Hydrographic Area

| County City | Agency* (Name and Type) | Period of Record | Yrs. of Rec. | Avg. Annual Water Into System (million gals.) | Average Estimated Population Served | Highest Monthly Use (gpcd) | Average Daily Water Use | | | | | | | | | | | | Total | |
|----------------|--------------------------------------|------------------------|--------------------|--|--|-------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------------------|------|
| | | | | | | | Monthly (gpcd) | | | | | | | | | | | | Annually gpcd | efpy |
| | | | | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| FRESNO | | | | | | | | | | | | | | | | | | | | |
| Fresno | - M.W.D. | 1961-65 | 5 | 19,262 | 165,951 | 667 | 122 | 146 | 176 | 289 | 332 | 524 | 618 | 564 | 414 | 279 | 172 | 132 | 318 | -356 |
| Delano | Cal. Water Service Co. (C.W.S.C.) | 1961-65 | 3 | 982 | 7,916 | 668 | 151 | 178 | 225 | 267 | 444 | 550 | 641 | 598 | 431 | 301 | 163 | 139 | 340 | -381 |
| KERN | | | | | | | | | | | | | | | | | | | | |
| Bakersfield | Cal. Water Service Co. (C.W.S.C.) | 1961-65 | 5 | 13,861 | 119,048 | 646 | 135 | 169 | 209 | 298 | 393 | 528 | 604 | 549 | 392 | 275 | 161 | 128 | 319 | -357 |
| Delano | - M.W.D. | 1962-65 | 4 | 1,774 | 12,329 | 751 | 177 | 200 | 263 | 342 | 472 | 587 | 654 | 630 | 464 | 336 | 190 | 179 | 376 | -421 |
| KINGS | | | | | | | | | | | | | | | | | | | | |
| Sanford | - M.W.D. | 1961-65 | 5 | 1,785 | 12,112 | 513 | 111 | 131 | 178 | 246 | 352 | 457 | 503 | 455 | 326 | 234 | 134 | 108 | 270 | -302 |
| TULARE | | | | | | | | | | | | | | | | | | | | |
| Tulare | - M.W.D. | 1961-65 | 5 | 1,684 | 14,887 | 671 | 127 | 143 | 196 | 269 | 392 | 542 | 601 | 533 | 375 | 263 | 158 | 119 | 310 | -347 |
| Visalia | Cal. Water Service Co. (C.W.S.C.) | 1961-65 | 5 | 2,757 | 28,929 | 554 | 103 | 121 | 153 | 219 | 328 | 464 | 531 | 473 | 326 | 208 | 123 | 99 | 262 | -291 |

* Refer to Table 3a for abbreviations (page 39).

The average annual gpcd values are essentially the same as those for the San Joaquin River Basin HA. The graphs of the annual monthly values in Figure 6 show the pattern of monthly use also to be quite similar. The noticeable difference is the tendency for a higher water use in the Tulare Lake Basin during the first half of the year and in the San Joaquin River Basin during the last half of the year. A reason may be, in part at least, the higher rainfall in the San Joaquin Basin, which results in greater soil moisture storage and delays the need for watering lawn and shrubbery areas.

More than three-fourth of the approximately 368,000 people included in the seven cities investigated live in the two largest communities in the area, Fresno and Bakersfield. These two cities have similar average annual per capita use. The average monthly values for Bakersfield, however, fluctuate less than those for Fresno.

In Bakersfield, more than 50 percent of the population served live outside the city boundaries in relatively low-density, low-water-using residential areas, while in Fresno, only about 10 percent of the population served live outside the

city. Because the Bakersfield unit values are strongly modified by the low water use of the suburban population, they are less than the Fresno values during the summer and fall. The reason for the reversal in the relationship during the winter is the year-round character of industrial use of water in the Bakersfield area. Industrial use is not primarily influenced by climate and hence does not drop during the winter.

Annual unit uses in Delano and Visalia, with similar climate and types of use, are quite dissimilar (376 and 262 gpcd, respectively). The difference is attributable to metering. Delano has no metering, while approximately 17 percent of Visalia's water connections are metered. These metered connections include most of the larger water-using commercial and industrial establishments, which are generally more strongly motivated through economic constraints to reduce waste.

As in Visalia, the industrial water use in Selma is highly metered. Selma has a larger number of industries with higher individual water requirements than Visalia and has a much lower population.

(South Lahontan HA) - This hydrographic area contains a little more than one percent of the State's population. The average monthly and annual data, available only for Victorville (which accounts for approximately four percent of the area's population) are shown in Table 31.

TABLE 31
AVERAGE MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER

SOUTH LAHONTAN
Hydrographic Area

CITIES

| County City | Agency* (Name and Type) | Period of Record | Yrs. of Rec. | Avg. Annual Water Into System (million gals.) | Average Estimated Population Served | Highest Monthly Use (gpcd) | Average Daily Water Use | | | | | | | | | | | | Total |
|----------------|----------------------------|------------------------|--------------------|--|--|-------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|
| | | | | | | | Monthly (gpcd) | | | | | | | | | | | | |
| | | | | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| SAN BERNARDINO | | | | | | | | | | | | | | | | | | | |
| Victorville | Victorville C.W.D. | 1961-65 | 5 | 901 | 8,279 | 366 | 132 | 148 | 183 | 294 | 312 | 422 | 487 | 509 | 450 | 321 | 209 | 136 | 298 |
| | | | | | | | | | | | | | | | | | | | .334 |

* Refer to Table 3a for abbreviations (page 39).

Although Victorville has a high mean temperature and low rainfall, it has a lower annual per capita water use than both the San Joaquin River and Tulare Lake Basin HA's. Part of the difference is due not only to the smaller number of industries in Victorville than in the other areas but also to the smaller average water requirements of its individual industries.

The low residential use of water is partly due to low per capita income and partly due to high summer temperatures, which restrict the number and variety of ornamental plants that can be grown. In Victorville, as in most of the desert communities, yard areas tend to be smaller than those in Central Valley communities. These conditions result in

less outside residential water use. Similar conditions also prevail in other communities in the area.

(Colorado Desert HA) - This area contains a little more than one percent of the State's population. Average monthly and annual water use data for approximately 15 percent of the area's population in the two communities of El Centro and Indio are shown in Table 3j.

COLORADO DESERT
Hydrographic Area

TABLE 3j
AVERAGE MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER

| County City | Agency * (Name and Type) | Period of Record | Yrs. of Rec. | Avg. Annual Water Into System (million gals.) | Average Estimated Population Served | Highest Monthly Use (gpcd) | Average Daily Water Use | | | | | | | | | | | | Total | |
|----------------|-----------------------------|------------------------|--------------------|--|--|-------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------|-------|
| | | | | | | | Monthly (gpcd) | | | | | | | | | | | | Annually | |
| | | | | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | gpcd | afpcy |
| IMPERIAL | | | | | | | | | | | | | | | | | | | | |
| El Centro | - M.W.D. | 1961-65 | 5 | 1,680 | 18,640 | 393 | 145 | 176 | 193 | 230 | 290 | 354 | 388 | 347 | 293 | 241 | 172 | 146 | 247 | 277 |
| RIVERSIDE | | | | | | | | | | | | | | | | | | | | |
| Indio | - M.W.D. | 1961-65 | 5 | 1,415 | 12,000 | 642 | 163 | 205 | 223 | 295 | 322 | 486 | 551 | 518 | 396 | 271 | 240 | 186 | 323 | 362 |

* Refer to Table 3a for abbreviations (page 39).

The Colorado Desert HA has an average annual unit water use that is 5 percent higher than the Sacramento River Basin, but its peak value is 5 percent less. Values for July, August, and September are higher in the Sacramento River Basin and for the remaining months (except for October when the value is the same for both areas) are higher in the Colorado Desert HA.

The lesser summer use, as in the South Lahontan HA, is primarily due to low income housing with small yards and low-water-using ornamental vegetation, while the higher use of water during the winter is accounted for by the longer growing season, which sustains the need for outside water application.

The rather pronounced higher use of water in Indio than in El Centro is due to the location of Indio. The community is a favorite stopover for weekend recreational travelers enroute to the Salton Sea and the Colorado River from the Los Angeles area. Also, the proximity of an important date and citrus industry, which requires considerable quantities of water for processing the fruit, results in a higher per capita use than in El Centro. Another influence, although indirect by comparison, is the recreational community of Palm Springs. It has raised the value of surrounding areas and encouraged residential and recreation-based commercial developments in Indio. Increased per capita water use results because of higher outside uses of water for landscaping and swimming pools and because of higher percentages of urban land devoted to greenery than in El Centro.

Private, Industry-Produced Fresh Water

Use of water agency records exclusively to obtain a complete picture of per capita water use will usually produce values that are lower than actual use. This is because a significant quantity of water produced by manufacturing establishments for their own use is not included. Some establishments use this water to supplement supplies purchased from water agencies; in other industries, it represents the entire supply of water used by that industry. The annual averages for private industry-produced water by hydrographic areas were obtained by weighting these water use values for each of those counties for which agency-produced unit values were obtained by the portion of that county's population within the hydrographic area, summing these quantities, and dividing this sum by the total population for the hydrographic area. Table 4 presents a summary of the hydrographic area values.

The data used in this procedure were developed from estimates of water used by manufacturers in each county based on reported intake by source (private or public) and number of employees for each industrial group, as presented in Bulletin No. 124. Data from approximately 5,400 reporting firms, representing approximately 50 percent of total manufacturing employment during the 1957-59 period, were used in these estimates. In Shasta County, a sizable additional use of water has been introduced since Bulletin No. 124 by a pulp mill near Anderson. In 1966, this mill used approximately 12,100 acre-feet of water, which was about the same as used in 1965. When this use is related to the populations of Shasta County and of the portion of the hydrographic area studied, it adds 145 gpcd and 11 gpcd, respectively.

The per capita water use values developed by county and used as a basis for computing the hydrographic area values are shown in Table 5. The total quantity of water represented by these figures is approximately 60 percent of all reported industrial fresh water intake. The balance of the water used is obtained from water service agencies. In general, the data reflects water use by the high-water-using industries. A more detailed analysis of unit water use of private, industry-produced fresh water may be found in Bulletin No. 124.

Private, Industry-Produced Brackish Water

The use of brackish water, while usually having little direct bearing on projects designed to harness and distribute fresh water, is of importance because it provides an insight into the extent that fresh water supplies might be substituted by brackish water in industries not now using brackish water, or vice versa. As coastal and inland bay sites for the location of such establishments diminish, some may be forced to locate inland and to rely on fresh water supplies. Knowing the water requirements of such industries is an important part

TABLE 4

AVERAGE ANNUAL URBAN UNIT WATER USE
PRIVATE, INDUSTRY-PRODUCED FRESH WATER
(1957-1959)

Hydrographic Areas

| Hydrographic Area | Estimated Private, Industry-Produced Fresh Water ^{1/} (million gal.) | Population (x 1000) <u>2/</u> | Average Annual | |
|----------------------------|---|----------------------------------|------------------|-------|
| | | | gpcd | afpcy |
| North Coastal | 8,600 | 279 | 84 | .094 |
| San Francisco Bay | 28,225 | 3,327 ^{4/} | 23 | .026 |
| Central Coastal | 7,750 | 568 | 37 | .041 |
| South Coastal | 30,192 | 7,521 ^{4/} | 11 | .012 |
| Sacramento River Basin | 13,847 ^{3/} | 762 ^{4/} | 50 | .056 |
| Delta-Central Sierra Basin | 9,787 | 308 ^{4/} | 87 | .097 |
| San Joaquin River Basin | 9,080 | 327 | 76 | .085 |
| Tulare Lake Basin | 10,115 | 830 | 33 | .037 |
| South Lahontan | 1,784 | 164 | 30 | .034 |
| Colorado Desert | 777 | 175 ^{4/} | 12 | .013 |
| SUMMARY | 120,157 | 14,261 ^{4/} | 23 ^{5/} | .026 |

^{1/} Developed from Table 5 . Water production values for portions of counties split by hydrographic area boundaries were apportioned from total county values using appropriate population figures.

^{2/} From U. S. Census data for 1960. Populations for portions of divided counties determined by Department of Water Resources.

^{3/} Does not include water used by pulp mill in Anderson, Shasta County. Although the 1960 use is not known, the 1966 use was estimated at 12,100 acre-feet. Relating this amount to the known 1965 population for the same area adds 11 gpcd.

^{4/} Populations of counties with gpcd values less than one (San Diego, Solano, and Yuba) were not included. In addition, the population for the portion of Napa County occurring in the Sacramento River Basin were not included because total water produced was less than one million gallons.

^{5/} This value differs from the value shown in Table 5 because of population differences. See footnote ^{4/}, above.

TABLE 5
AVERAGE ANNUAL URBAN UNIT WATER USE
PRIVATE, INDUSTRY-PRODUCED FRESH WATER
(1957-1959)

Counties

| County | Population (x 1000) <u>1/</u> | Estimated Total County Fresh Water <u>2/</u> (Million gals.) | Percent Private, Industry- Produced <u>3/</u> | Estimated Private Industry-Produced Fresh Water (Million gals.) | Average Annual | |
|------------------|----------------------------------|---|--|--|----------------|-------|
| | | | | | gpcd | afpcy |
| Alameda | 908.2 | 11,614 | 46 | 5,354 | 16 | .018 |
| Amador | 10.0 | 321 | 26 | 83 | 23 | .026 |
| Butte | 82.0 | 1,905 | 97 | 1,841 | 62 | .069 |
| Contra Costa | 409.0 | 39,112 | 52 | 20,377 | 136 | .153 |
| Del Norte | 17.8 | 88 | 97 | 85 | 13 | .015 |
| Fresno | 365.9 | 7,436 | 75 | 5,599 | 42 | .047 |
| Glenn | 17.2 | 1,213 | 100 | 1,208 | 192 | .215 |
| Humboldt | 104.9 | 5,414 | 58 | 3,113 | 81 | .091 |
| Imperial | 72.1 | 1,418 | 13 | 179 | 7 | .008 |
| Kern | 292.0 | 4,172 | 75 | 3,112 | 29 | .033 |
| Kings | 50.0 | 1,584 | 73 | 1,163 | 64 | .071 |
| Lake | 13.8 | 177 | 99 | 176 | 35 | .039 |
| Los Angeles | 6,038.8 | 73,090 | 34 | 24,997 | 11 | .013 |
| Madera | 40.5 | 874 | 99 | 869 | 59 | .066 |
| Marin | 146.8 | 266 | 17 | 45 | 1 | .001 |
| Mendocino | 51.1 | 3,993 | 99 | 3,957 | 212 | .238 |
| Merced | 90.4 | 2,377 | 98 | 2,332 | 71 | .079 |
| Monterey | 198.3 | 3,132 | 98 | 3,057 | 42 | .047 |
| Napa | 65.9 | 446 | 3 | 15 | 1 | .001 |
| Orange | 703.9 | 5,803 | 26 | 1,491 | 6 | .006 |
| Placer | 53.8 | 198 | 65 | 129 | 6 | .007 |
| Riverside | 306.2 | 2,330 | 72 | 1,677 | 15 | .017 |
| Sacramento | 502.8 | 5,593 | 88 | 4,911 | 27 | .030 |
| San Benito | 15.4 | 388 | 99 | 383 | 68 | .076 |
| San Bernardino | 503.6 | 5,584 | 61 | 3,412 | 19 | .021 |
| San Diego | 1,033.0 | 6,096 | 1 | 67 | - | - |
| San Francisco | 740.3 | 3,428 | 5 | 165 | 1 | .001 |
| San Joaquin | 250.0 | 9,075 | 85 | 7,750 | 85 | .095 |
| San Luis Obispo | 81.0 | 805 | 93 | 750 | 25 | .028 |
| San Mateo | 444.4 | 2,105 | 12 | 251 | 2 | .002 |
| Santa Barbara | 169.0 | 2,759 | 99 | 2,726 | 44 | .050 |
| Santa Clara | 642.3 | 6,013 | 71 | 4,287 | 18 | .020 |
| Santa Cruz | 84.2 | 733 | 87 | 640 | 21 | .023 |
| Shasta <u>4/</u> | 59.5 | 4,361 | 99 | 4,326 | 199 | .223 |
| Solano | 134.6 | 266 | 1 | 3 | - | - |
| Sonoma | 147.4 | 2,220 | 91 | 2,024 | 38 | .042 |
| Stanislaus | 157.3 | 6,571 | 74 | 4,830 | 84 | .094 |
| Sutter | 33.4 | 258 | 67 | 172 | 14 | .016 |
| Tehama | 25.3 | 2,646 | 49 | 1,289 | 140 | .156 |
| Tulare | 168.4 | 1,030 | 77 | 797 | 13 | .015 |
| Ventura | 199.1 | 1,419 | 41 | 585 | 8 | .009 |
| Yuba | 33.9 | 3 | 77 | 2 | - | - |
| SUMMARY | 15,463.5 | 228,316 | 53 | 120,229 | 21 | .023 |

1/ 1960 U. S. Census

2/ From Table 6, Bulletin No. 124, "Water Use by Manufacturing Industries in California 1957-59".

3/ Computed from Table 2, Bulletin No. 124.

4/ Does not include water used by pulp mill in Anderson. Although the 1960 use is not known, the 1966 use was estimated at 12,100 acre feet. Relating this amount to the known 1965 population for the county adds 145 gpcd.

of water development planning irrespective of quality of water. Average annual per capita brackish water values are shown by hydrographic area in Table 6. The county values developed from Bulletin No. 124 data and used to derive the hydrographic area values are presented in Table 7. The data presented in Tables 6 and 7 account for 46 percent of all intake water used by manufacturing establishments (excluding intake of water for cooling and for steam generation plants) and exceed fresh water intake from either public water supplies or from company-produced sources. The highest users are the petroleum refining and related industries group, which rely on brackish water for 75 percent of their intake, and the chemical and allied products group, which use 53 percent brackish water. A more thorough analysis of unit water use of private, industry-produced brackish water may be found in Bulletin No. 124.

Total Per Capita Water Use

In Table 8, the three main components of urban per capita water use are summarized by county within hydrographic areas. In Tables 9 and 10, separate listings of per capita water use are presented by hydrographic areas and by counties.

The data in Table 10 discloses that, in all counties except Mendocino, agency-produced water was the main source of fresh water. In 14 of the 43 counties reported upon, private, industry-produced fresh water provides more than 20 percent of the total fresh water used in the counties. The importance of this component is clearly seen in the values for the three counties in the North Coastal HA. The addition of private, industry-produced fresh water has resulted in a complete reversal of the agency-produced county values. Del Norte county goes from the highest to the lowest user of the three, while Mendocino goes from the lowest to the highest.

Table 9 also clearly shows the changing relationships that can result. For example, the ranking of the San Francisco Bay HA per capita use value on the basis of agency-produced data is second lowest of the 11 areas. When private, industry-produced fresh water is added, it acquires the lowest ranking. Adding brackish water boosts it back up to the second lowest spot.

TABLE 6

AVERAGE ANNUAL URBAN UNIT WATER USE
PRIVATE, INDUSTRY-PRODUCED BRACKISH WATER
(1957-1959)

Hydrographic Areas

| Hydrographic Area | Estimated Brackish Water (Million Gals) <u>1/</u> | Population (x 1000) <u>2/</u> | Average Annual | |
|-------------------------|--|-------------------------------------|----------------|-------|
| | | | gpcd | afpcy |
| North Coastal | 3,099 | 227 | 37 | .041 |
| San Francisco Bay | 46,263 | 3,115 | 41 | .046 |
| Central Coastal | 2,181 | 219 | 27 | .030 |
| South Coastal | 90,534 | 8,128 | 30 | .034 |
| Sacramento River Basin | - | - | - | - |
| Delta-Central Sierra | 9,334 | 273 | 94 | .105 |
| San Joaquin River Basin | 616 | 29 | 58 | .065 |
| Tulare Lake Basin | 6,560 | 168 | 107 | .120 |
| South Lahontan | 1,274 | 127 | 27 | .030 |
| Colorado River Basin | 90 | 24 | 10 | .011 |
| SUMMARY | 159,951 | 12,310 | 36 | .040 |

1/ Developed from Table 7 . Water production values for portions of counties split by hydrographic area boundaries were apportioned from total county values using appropriate population figures.

2/ From U. S. Census data for 1960. Populations for portions of divided counties determined by Department of Water Resources.

TABLE 7

AVERAGE ANNUAL URBAN UNIT WATER USE
PRIVATE, INDUSTRY-PRODUCED BRACKISH WATER
(1957-1959)

Counties

| County | Estimated Brackish Water (million gal.) <u>1/</u> | Population (x 1000) <u>2/</u> | Average Annual | |
|----------------|--|-------------------------------------|----------------|-------|
| | | | gpcd | afpcy |
| Alameda | 5,495 | 908.2 | 16 | .018 |
| Contra Costa | 37,304 | 409.0 | 250 | .280 |
| Del Norte | 33 | 17.8 | 5 | .006 |
| Humboldt | 2,306 | 104.9 | 60 | .067 |
| Los Angeles | 77,424 | 6,038.8 | 35 | .039 |
| Monterey | 2,057 | 198.3 | 28 | .031 |
| Orange | 3,771 | 703.9 | 15 | .017 |
| San Bernardino | 1,654 | 503.6 | 9 | .010 |
| San Diego | 8,944 | 1,033.0 | 24 | .027 |
| San Francisco | 4,094 | 740.3 | 15 | .017 |
| San Joaquin | 5,048 | 250.0 | 55 | .062 |
| San Mateo | 1,015 | 444.4 | 6 | .007 |
| Santa Clara | 3,075 | 642.3 | 13 | .015 |
| Sonoma | 1,066 | 147.4 | 20 | .022 |
| Tulare | 6,560 | 168.4 | 11 | .012 |
| SUMMARY | 159,846 | 12,310.3 | 36 | .040 |

1/ Developed from data in Tables 2 and 6 of Bulletin No. 124, "Water Use by Manufacturing Establishments in California, 1957-1959", assuming a direct relationship between number of employees and water use and between fresh and brackish water use in those industries using brackish water.

2/ 1960 U. S. Census

TABLE 8
AVERAGE ANNUAL URBAN UNIT WATER USE
COMBINED SOURCES

Counties by Hydrographic Area

| HA <u>1/</u> | County | Total Per Capita Use (gpcd) | Brackish Private Industry Produced (gpcd) | Fresh Water | | Total Fresh | |
|-------------------|-----------------|---|---|---|--|-------------|-------|
| | | | | Agency Produced (gpcd) <u>2/</u> | Private, Industry Produced (gpcd) | | |
| | | | | | | gpcd | afpcy |
| NC | Del Norte | 156 | 5 | 138 | 13 | 151 | .169 |
| | Humboldt | 263 | 60 | 122 | 81 | 203 | .227 |
| | Marin | 1 | - | - | 1 | 1 | .001 |
| | Mendocino | 379 | - | 167 | 212 | 379 | .425 |
| | Sonoma | 217 | 20 | 159 | 38 | 197 | .221 |
| SF | Alameda | 190 | 16 | 158 | 16 | 174 | .177 |
| | Contra Costa | 548 | 250 | 162 | 136 | 298 | .350 |
| | Marin | 149 | - | 148 | 1 | 149 | .167 |
| | Napa | 179 | - | 178 | 1 | 179 | .200 |
| | San Francisco | 141 | 15 | 125 | 1 | 126 | .141 |
| | Santa Clara | 188 | 13 | 157 | 18 | 175 | .196 |
| | San Mateo | 132 | 6 | 124 | 2 | 126 | .141 |
| | Solano | 185 | - | 185 | - | 185 | .207 |
| CC | Sonoma | 218 | 20 | 173 | 38 | 211 | .236 |
| | Monterey | 193 | 28 | 123 | 42 | 165 | .185 |
| | San Benito | 216 | - | 148 | 68 | 216 | .242 |
| | San Luis Obispo | 213 | - | 188 | 25 | 213 | .238 |
| | Santa Barbara | 212 | - | 168 | 44 | 212 | .237 |
| | Santa Clara | 199 | 13 | 168 | 18 | 186 | .208 |
| SC | Santa Cruz | 178 | - | 157 | 21 | 178 | .199 |
| | Los Angeles | 218 | 35 | 172 | 11 | 183 | .205 |
| | Orange | 206 | 15 | 185 | 6 | 191 | .214 |
| | Riverside | 244 | - | 229 | 15 | 244 | .273 |
| | San Bernardino | 240 | 9 | 212 | 19 | 231 | .259 |
| | San Diego | 150 | 24 | 126 | - | 126 | .141 |
| SB | Ventura | 166 | - | 158 | 8 | 166 | .186 |
| | Butte | 392 | - | 330 | 62 | 392 | .439 |
| | Glenn | 464 | - | 272 | 192 | 464 | .520 |
| | Lake | 185 | - | 151 | 35 | 186 | .208 |
| | Napa | 1 | - | - | 1 | 1 | .001 |
| | Placer | 293 | - | 287 | 6 | 293 | .328 |
| | Sacramento | 278 | - | 251 | 27 | 278 | .311 |
| | Shasta | 449 | - | 250 | 199 | 449 | .503 |
| | Solano | - | - | - | - | - | - |
| | Sutter | 241 | - | 227 | 14 | 241 | .270 |
| DC | Tehama | 427 | - | 287 | 140 | 427 | .478 |
| | Yuba | 283 | - | 283 | - | 283 | .317 |
| | Alameda | 32 | 16 | - | 16 | 16 | .018 |
| | Amador | 339 | - | 316 | 23 | 339 | .380 |
| | Contra Costa | 386 | 250 | - | 136 | 136 | .152 |
| | Sacramento | 27 | - | - | 27 | 27 | .030 |
| | San Joaquin | 370 | 55 | 230 | 85 | 315 | .353 |
| | Solano | 185 | - | 185 | - | 185 | .207 |
| SJ | Stanislaus | 316 | - | 232 | 84 | 316 | .354 |
| | Fresno | 42 | - | - | 42 | 42 | .047 |
| | Madera | 410 | - | 351 | 59 | 410 | .459 |
| | Merced | 357 | - | 286 | 71 | 357 | .400 |
| | San Joaquin | 140 | 55 | - | 85 | 85 | .095 |
| TB | Stanislaus | 414 | - | 330 | 84 | 414 | .464 |
| | Fresno | 360 | - | 318 | 42 | 360 | .403 |
| | Kern | 354 | - | 325 | 29 | 354 | .396 |
| | Kings | 334 | - | 270 | 64 | 334 | .374 |
| | San Benito | 68 | - | - | 68 | 68 | .076 |
| SL | Tulare | 302 | 11 | 278 | 13 | 291 | .326 |
| | Kern | 29 | - | - | 29 | 29 | .032 |
| | Los Angeles | 11 | 35 | - | 11 | 11 | .012 |
| CD | San Bernardino | 326 | 9 | 298 | 19 | 317 | .355 |
| | Imperial | 254 | - | 247 | 7 | 254 | .284 |
| | Riverside | 338 | - | 323 | 15 | 338 | .378 |
| | San Bernardino | 28 | 9 | - | 19 | 19 | .021 |
| CD | San Diego | 24 | 24 | - | - | - | - |
| | San Diego | 24 | 24 | - | - | - | - |
| WEIGHTED AVERAGES | | 2293/ | 36 | 172 | 21 | 1933/ | .216 |

1/ HA - Hydrographic Area

2/ Unit values for portions of divided counties differ because they have been weighted by average populations of communities studied in each portion. Missing values indicate no communities were studied in that portion of the county.

3/ Obtained by summing laterally. These values cannot be obtained by weighting the HA values above them because of the use of two different population bases for obtaining total fresh water.

TABLE 9
AVERAGE ANNUAL URBAN UNIT WATER USE
COMBINED SOURCES

Hydrographic Areas

| Hydrographic Area | Total Per Capita Use (gpcd) | Brackish | Fresh Water | | | |
|----------------------------|-----------------------------|-----------------------------------|------------------------|----------------------------------|-------------|-------|
| | | Private, Industry Produced (gpcd) | Agency Produced (gpcd) | Private Industry Produced (gpcd) | Total Fresh | |
| | | | | | gpcd | afpcy |
| North Coastal | 264 | 37 | 143 | 84 | 227 | .254 |
| San Francisco Bay | 210 | 41 | 146 | 23 | 169 | .189 |
| Central Coastal | 212 | 27 | 148 | 37 | 185 | .207 |
| South Coastal | 208 | 30 | 167 | 11 | 178 | .199 |
| Sacramento River Basin | 313 | - | 263 | 50 | 313 | .350 |
| Delta-Central Sierra Basin | 408 | 94 | 227 | 87 | 314 | .352 |
| San Joaquin River Basin | 450 | 58 | 317 | 76 | 392 | .439 |
| Tulare Lake Basin | 454 | 107 | 314 | 33 | 347 | .389 |
| South Lahontan | 355 | 27 | 298 | 30 | 328 | .367 |
| Colorado Desert | 299 | 10 | 277 | 12 | 289 | .324 |
| WEIGHTED AVERAGES | 231* | 36 | 172 | 23 | 195* | .218 |

* Obtained by summing laterally. These values cannot be obtained by weighting the HA values above them because of the use of two different population bases for obtaining total fresh water.

TABLE 10

AVERAGE ANNUAL URBAN UNIT WATER USE
COMBINED SOURCESCounties

| County | Total Per Capita Use (gpcd) | Brackish | Fresh Water | | | |
|-----------------|---|--|------------------------------|--|-------------|-------|
| | | Private, Industry Produced (gpcd) | Agency Produced (gpcd) | Private, Industry Produced (gpcd) | Total Fresh | |
| | | | | | gpcd | afpcy |
| Alameda | 174 | 6 | 142 | 16 | 158 | .177 |
| Amador | 339 | - | 316 | 23 | 339 | .380 |
| Butte | 392 | - | 330 | 62 | 392 | .439 |
| Contra Costa | 563 | 250 | 177 | 136 | 313 | .351 |
| Del Norte | 156 | 5 | 138 | 13 | 151 | .169 |
| Fresno | 360 | - | 318 | 42 | 360 | .403 |
| Glenn | 464 | - | 272 | 192 | 464 | .520 |
| Humboldt | 263 | 60 | 122 | 81 | 203 | .227 |
| Imperial | 254 | - | 247 | 7 | 254 | .284 |
| Kern | 353 | - | 324 | 29 | 353 | .395 |
| Kings | 334 | - | 270 | 64 | 334 | .374 |
| Lake | 186 | - | 157 | 35 | 186 | .208 |
| Los Angeles | 217 | 35 | 171 | 11 | 182 | .204 |
| Madera | 410 | - | 351 | 59 | 410 | .459 |
| Marin | 148 | - | 147 | 1 | 148 | .166 |
| Mendocino | 379 | - | 167 | 212 | 379 | .425 |
| Merced | 357 | - | 286 | 71 | 357 | .400 |
| Monterey | 193 | 28 | 123 | 42 | 165 | .185 |
| Napa | 179 | - | 178 | 1 | 179 | .200 |
| Orange | 206 | 15 | 185 | 6 | 191 | .214 |
| Placer | 293 | - | 287 | 6 | 293 | .328 |
| Riverside | 249 | - | 234 | 15 | 249 | .279 |
| Sacramento | 278 | - | 251 | 27 | 278 | .311 |
| San Benito | 215 | - | 147 | 68 | 215 | .241 |
| San Bernardino | 247 | 9 | 219 | 19 | 238 | .267 |
| San Diego | 150 | 24 | 126 | - | 126 | .141 |
| San Francisco | 141 | 15 | 125 | 1 | 126 | .141 |
| San Joaquin | 370 | 55 | 230 | 85 | 315 | .353 |
| San Luis Obispo | 213 | - | 188 | 25 | 213 | .238 |
| San Mateo | 132 | 6 | 124 | 2 | 126 | .141 |
| Santa Barbara | 212 | - | 168 | 44 | 212 | .237 |
| Santa Clara | 188 | 13 | 157 | 18 | 175 | .196 |
| Santa Cruz | 178 | - | 157 | 21 | 178 | .199 |
| Shasta | 449 | - | 250 | 199 | 449 | .503 |
| Solano | 185 | - | 185 | - | 185 | .207 |
| Sonoma | 218 | 20 | 160 | 38 | 198 | .222 |
| Stanislaus | 414 | - | 330 | 84 | 414 | .464 |
| Sutter | 241 | - | 227 | 14 | 241 | .270 |
| Tehama | 427 | - | 287 | 140 | 427 | .478 |
| Tulare | 302 | 11 | 278 | 13 | 291 | .326 |
| Ventura | 166 | - | 158 | 8 | 166 | .186 |
| Yuba | 283 | - | 283 | - | 283 | .317 |
| WEIGHTED AVER. | 229* | 36 | 172 | 21 | 193* | .216 |

* Obtained by summing laterally. These values cannot be obtained by weighting the HA values above them because of the use of two different population bases for obtaining total fresh water.

Other Components of Urban Water Use*

In addition to the three components of urban per capita water use discussed in the previous sections, two additional components exist. These components are privately produced water by residential users and by commercial establishments. The significance of these components depends largely on whether there is an available ground water supply and whether the community has incorporated into its water system many areas originally without municipal water. One area where this condition is significant is South Alameda County. The expanding cities have annexed a large number of urban areas previously without an incorporated water system and the residential users have continued to supply their needs by individual wells. Unfortunately, there is no source of information which can provide an insight into the magnitude of such uses. For this reason, it can only be mentioned here that these components do exist and that any endeavor to quantify them will be a future undertaking.

* A more complete discussion of this subject is presented under "Unreported Water Use", Chapter II.

CHAPTER IV. TRENDS IN PER CAPITA WATER USE

The limitations in using long-term data in developing representative per capita values for various regions of the State were discussed in the previous chapter. However, such data have considerable utility for other purposes. They are especially useful in revealing the nature of monthly urban water use. For example, the data can be used to determine: (1) fluctuations in monthly values around a mean, (2) which month has the greatest variability in relation to the mean value, and (3) the general direction of use, whether up or down, with time. The latter item is important because it may provide a clue to the factors that influence total use.

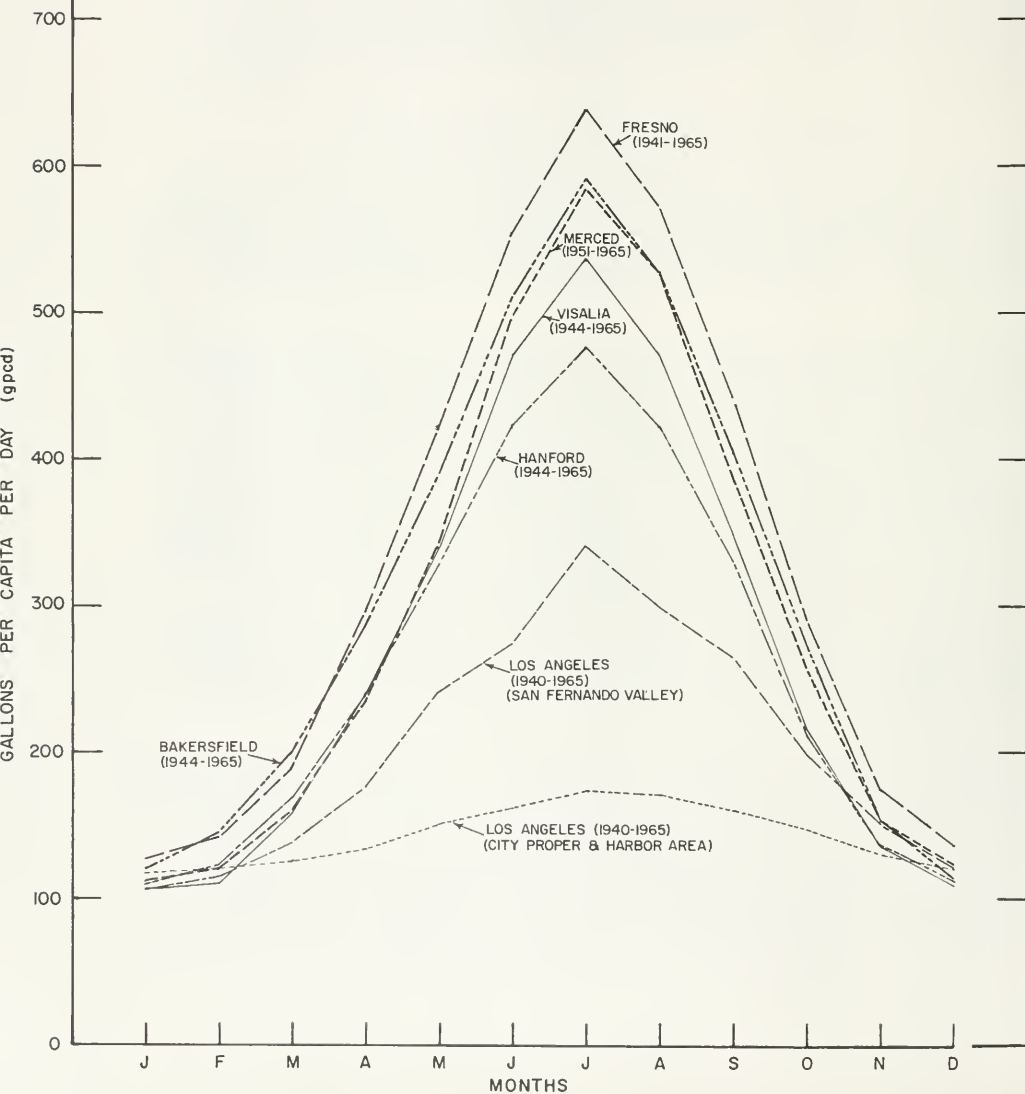
Variability and Trends of Monthly Values

Long-period averages, covering periods ranging from 15 to 26 years, of six cities have been plotted in Figure 8 to show the appreciable differences in monthly use between communities in similar climatic-geographic regions and the large differences between cities in dissimilar climatic-geographic regions.

The analysis was limited to five cities in the San Joaquin Valley (Merced, Fresno, Hanford, Visalia, and Eakersfield) and two portions of Los Angeles because long-term monthly values either were not available for other communities or were not practical to develop. Although the trends in the San Joaquin Valley may not be entirely typical of those in larger population centers, they reveal a number of factors affecting urban water use which can help to explain monthly unit use patterns in any community. As an example, the data revealed that the direction and magnitude of yearly fluctuations for many months (including winter months) were generally quite similar in each of the five cities. This similarity between dissimilar cities is due to the influence of climatic factors on outside use. The similarity during the winter months indicates that climate is more important during this period than had been supposed.

Some of the more important reasons for the differences between the five cities in the San Joaquin Valley are discussed in Chapter III under the sections "San Joaquin River Basin HA" and "Tulare Lake Basin HA". The differences shown between the two portions of Los Angeles which lie in two different climatic zones, and between those areas and the San Joaquin Valley cities are primarily due to climate. The relationship of water use to climate in the three climatic zones represented by these cities is discussed more fully in the section

LONG-TERM
AVERAGE MONTHLY URBAN UNIT WATER USE
AGENCY PRODUCED WATER



on "Temperature" in Chapter II. In the sections below, the monthly pattern of per capita use in the six cities is examined in some detail. Figures 9a through 9f show monthly data for each city. Averages for the data have been drawn as have high and low values.

San Joaquin Valley Cities

Merced (Figure 9a) - Per capita water use increased rather steadily for every month during the 15 years studied. September appears to be the least variable month with a 27 percent range in values from the average. January is next, followed by December and July. The most variable month appears to be April with 27 percent range in values from the average. October and March follow with ranges of 57 to 55 percent, respectively. The high range in March, April, and October is primarily due to erratic rainfall patterns.

Fresno (Figure 9b) - The monthly trends in this city for the 25 year period studied are not as definite as in Merced. The data reveal essentially no trend for nine months and a downward trend for three months; no upward trends are apparent. The comparison of the most recent five year average with the 25 year average shows that every month except February has shown a downward trend in per capita use. Most of the reasons for the downward trend are explained in Chapter III. As observed in Merced, per capita use in September shows the smallest percent in range of values from the average, followed by July and August. April again shows the greatest variability, followed by March and December. The variability during the winter in Fresno is more than twice as great as in Merced. This is due to the influence of relatively high manufacturing use of water in Fresno.

Hanford (Figure 9c) - The 22 years of data reveal apparently two different trends. In the winter months of November, December, and January, a noticeable downward trend exists, whereas from April through October there is a definite upward trend. What causes these two patterns is not known. The lowest range in values from the average occurs in August, followed by September and July. The greatest range occurs in January and is followed by March and February.

Visalia (Figure 9d) - Trends in this city over the 22 years studied appear to be quite variable. The months of June, July, and August are the only ones that show an upward trend. Except for March and October, the rest of the months show a declining per capita water use. During four of the months, the monthly trends established during the first 18 years of record appear to have been disrupted by approximately the last six. In February the

FIGURE 9a
 YEARLY FLUCTUATIONS AND AVERAGES
 OF MONTHLY URBAN
 PER CAPITA WATER USE
 MERCED, 1951-1965

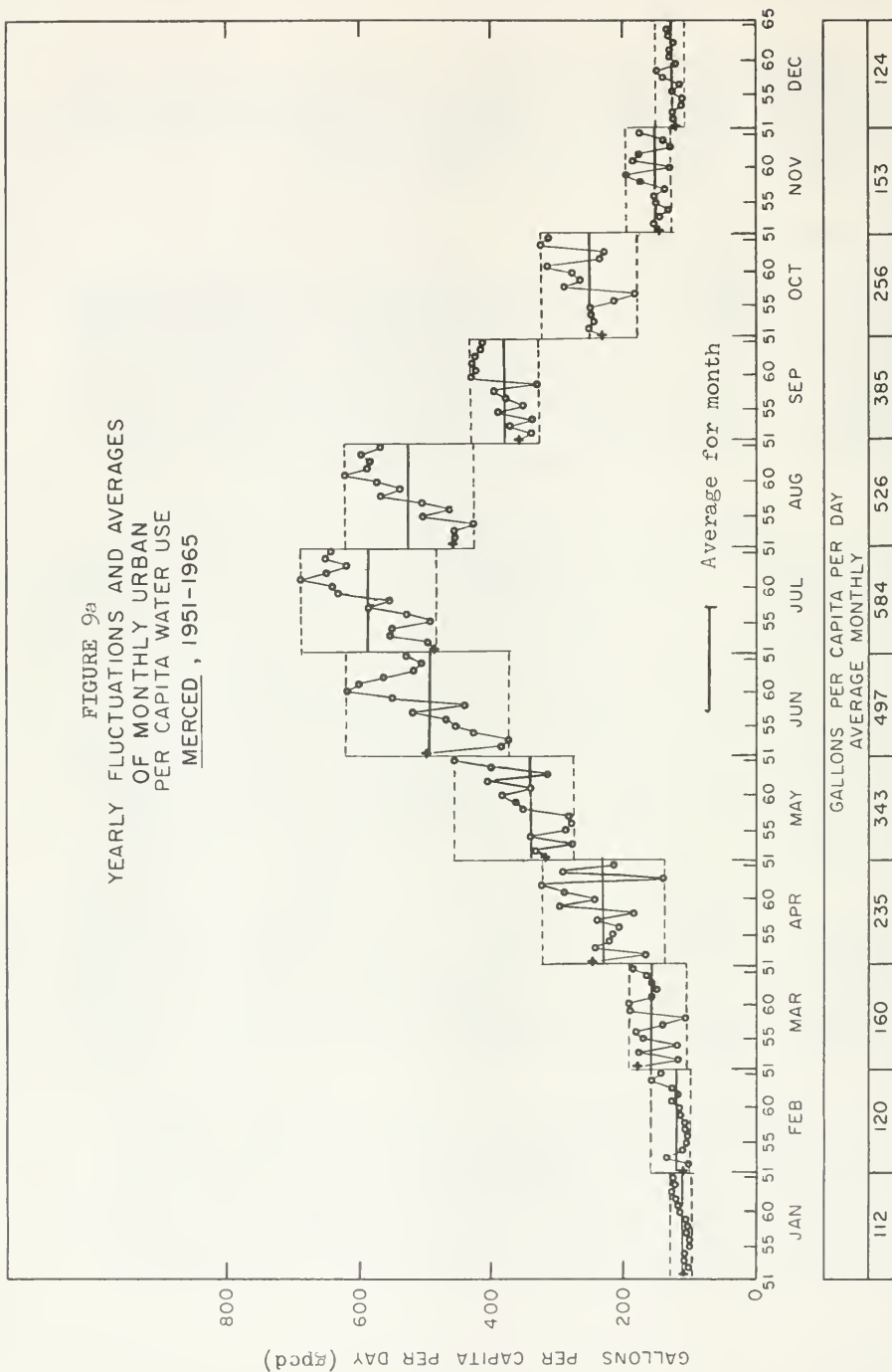
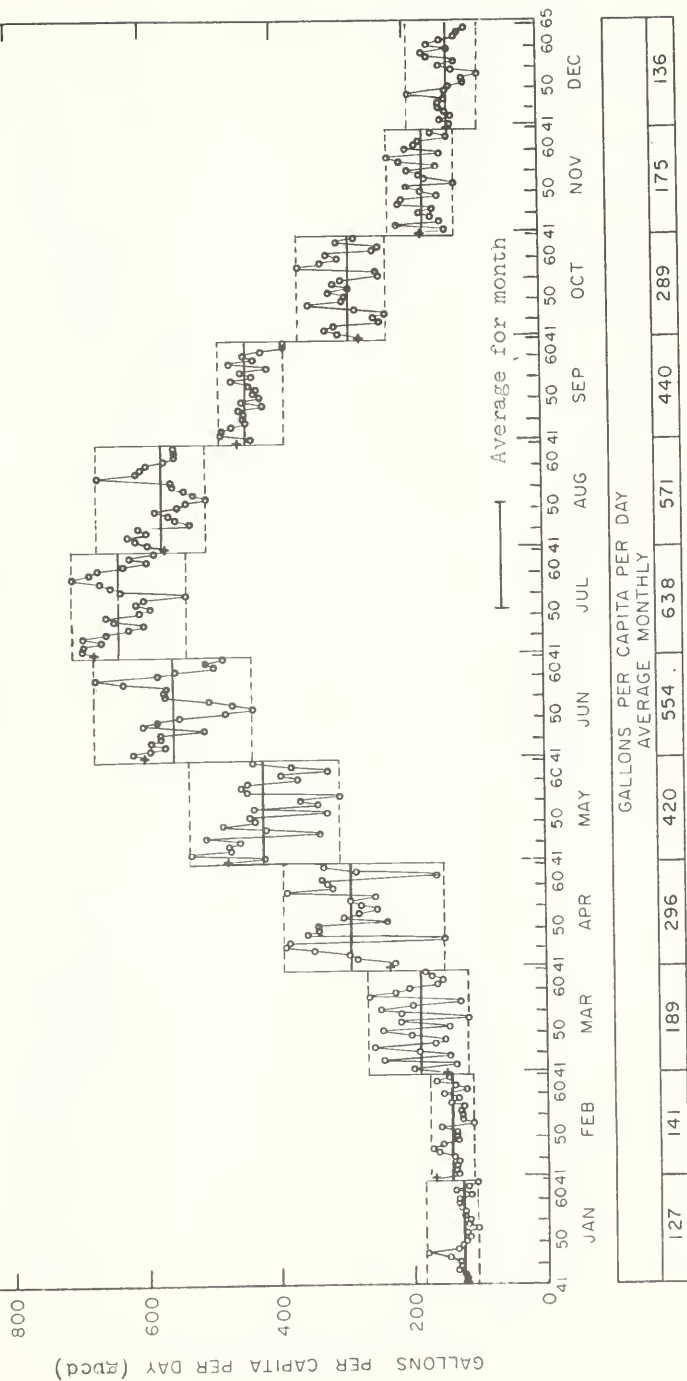
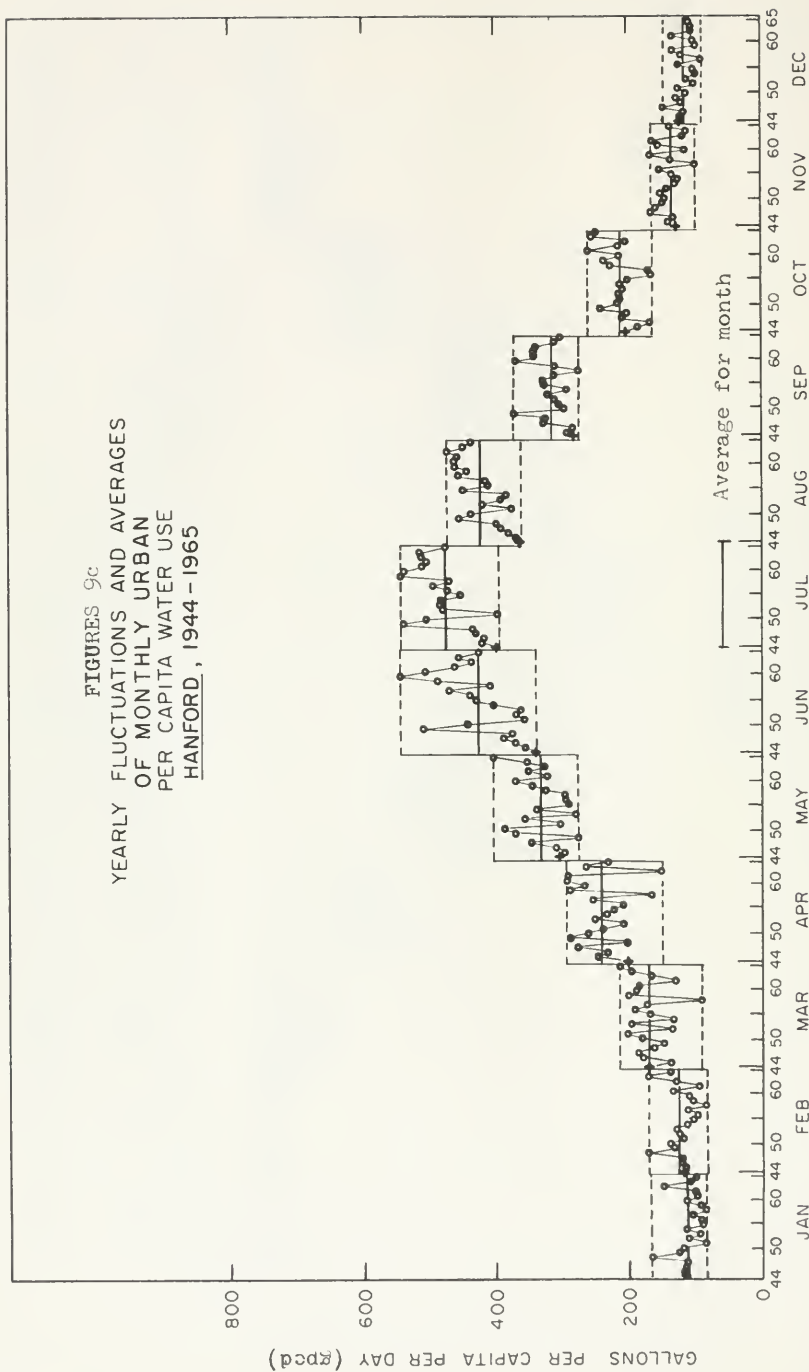


FIGURE 9b
YEARLY FLUCTUATIONS AND AVERAGES
OF MONTHLY URBAN
PER CAPITA WATER USE
FRESNO, 1941-1965



FIGURES 9c
YEARLY FLUCTUATIONS AND AVERAGES
OF MONTHLY URBAN
PER CAPITA WATER USE
HANFORD, 1944-1965



GALLONS PER CAPITA PER DAY

AVERAGE MONTHLY

110

122

169

240

329

424

476

421

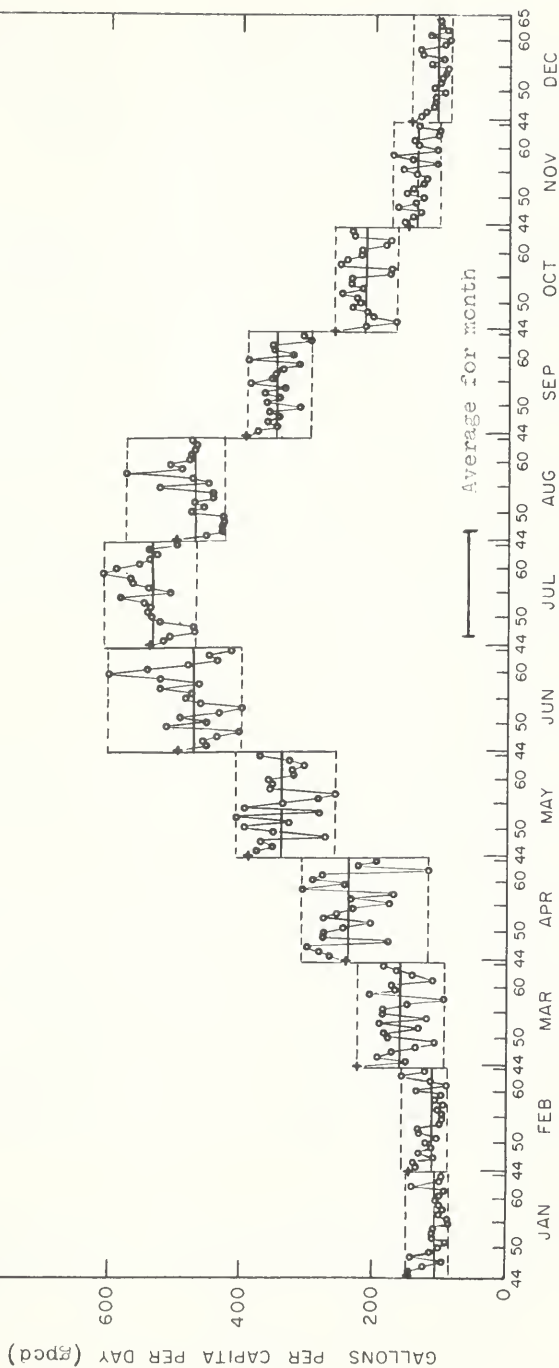
330

211

136

112

FIGURE 9d
 YEARLY FLUCTUATIONS AND AVERAGES
 OF MONTHLY URBAN
 PER CAPITA WATER USE
 VISALIA, 1944-1965



downward trend has been interrupted by a sizable uptrend. In contrast, the definite upward trends noted in June, July, and August have been interrupted by downward trends. July values range least from the average followed by September and then August. The highest range occurs in March, followed by April and February.

Bakersfield - Data covering the period 1944 to 1965 are shown in Figure 9e. Of particular interest in this city is the greater variability in the use of water, with respect to the average, during January and February than in the other cities studied. This variability is due to the outside use of water. The relatively mild winter conditions that frequently prevail in the city encourage vegetative growth. Because rainfall generally is insufficient to meet outside plant needs, some watering is necessary. When this condition prevails, even a small amount of external watering becomes a large part of the total use. As a result, per capita values tend to reflect this use. Since the factors that give rise to this condition are quite variable, per capita use also is quite variable. The least variability around the average occurs in the month of July, followed by August and November. For some unknown reason the range in values from the average for July was only 18 percent, which is considerably less than for the other cities.

Combined San Joaquin Valley Cities

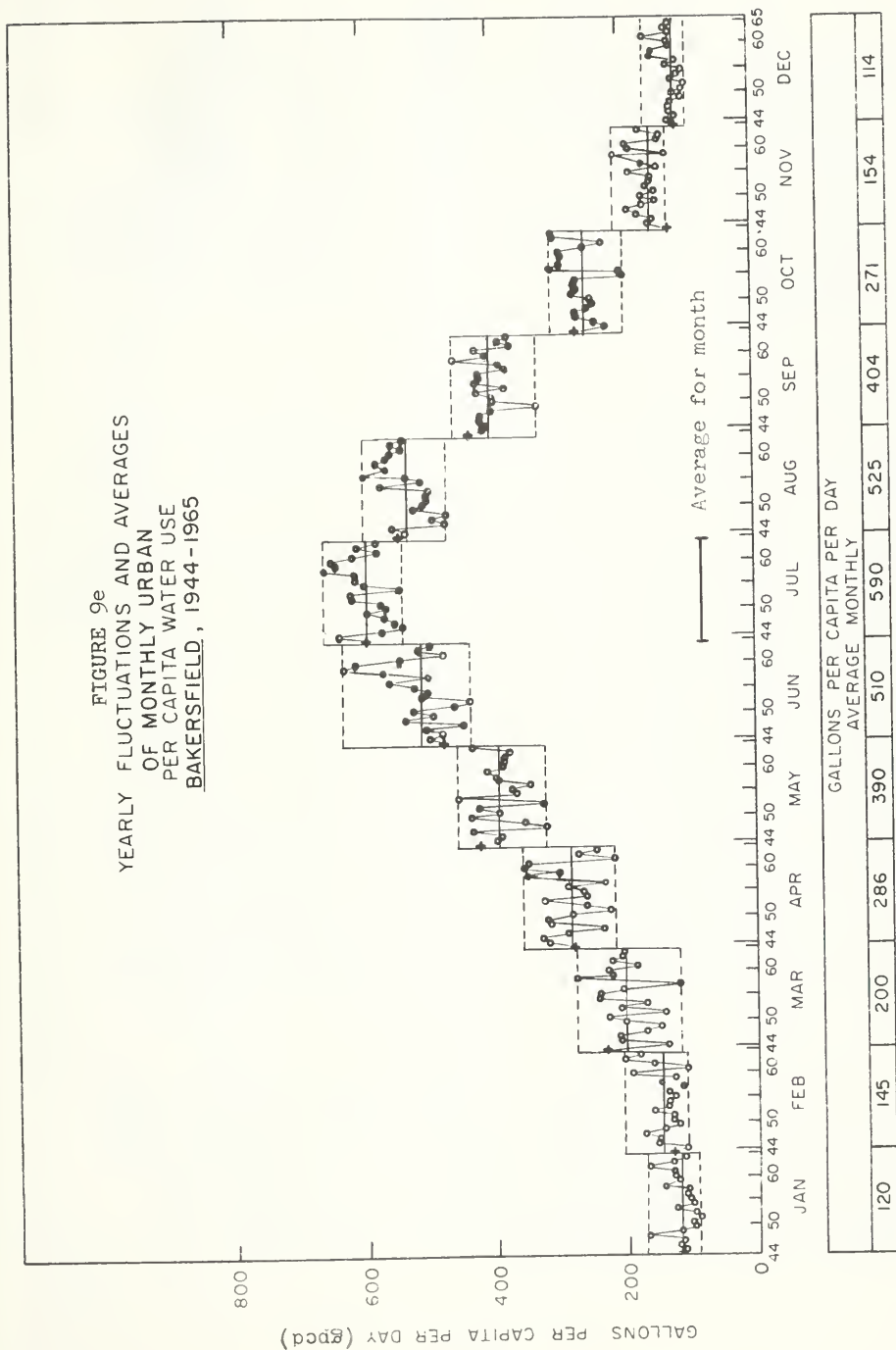
The monthly unit values for the period 1944-1965 for four of the five cities discussed above were weighted by population and evaluated using the two-variable least squares method to determine if these historic unit values would provide a statistically sound basis for extrapolating future monthly values.

The limitations in using annual unit values for this purpose have already been pointed out. Although encumbered by many of the same problems, the extrapolation of historic monthly values would be expected to provide a more reliable system. The results, however, as presented in Figure 10*, indicate that the values for cities in the Tulare Lake Basin are too variable for this purpose. This is shown on Figure 10 graphically by the range lines and statistically by the low correlation coefficients. Only September has a correlation coefficient greater than the acceptable minimum value of 0.4 for a two-variable least squares analysis consisting of 22 data points.

The coefficients for the remaining 11 months, being less than 0.4, indicate that the trend lines, irrespective of degree of slope, are not reliable for use in extrapolating future per capita unit use values. The apparent lack of a time-trend between gpcd unit values and time in this hydrographic area

* Bound at end of the report.

FIGURE 9e
YEARLY FLUCTUATIONS AND AVERAGES
OF MONTHLY URBAN
PER CAPITA WATER USE
BAKERSFIELD, 1944-1965



appears to contradict a common notion that such values increase during a time of increasing urban complexities. The analysis also clearly demonstrates the need for more information on the individual component urban uses and for a comprehensive in-depth evaluation of various factors influencing each of these uses. In addition, the results appear to justify the investigation of trends in unit water use on some basis other than time as well as the relationship between total urban water use and time. Although encumbered by many of the same problems, the extrapolation and averaging of annual values from monthly values should prove to be a more reliable system.

Los Angeles

To evaluate climatic influences on per capita water use in Los Angeles, the two climatic zones of the city were studied. Twenty-six years of data for each zone (San Fernando Valley and the city proper and harbor areas) are shown on Figure 9f .

The trends in the San Fernando Valley are rather definite, with summer months showing declining per capita use, winter months showing increasing use, and spring and fall periods showing mixed conditions. The increasing values for the winter months are believed due to increased use of water inside the home resulting from the extensive development of new residential areas and an accompanying increase in the per-household number of water-using appliances.

The downward trend in the summer months contrasts with the upward trends shown in four of the five San Joaquin Valley cities and in the city proper and harbor portion of Los Angeles. Although the basis for this trend has not been thoroughly studied, the nature of land development in the area provides a reasonable explanation. Much of the area is experiencing second-cycle growth, with multiple residential dwellings replacing single residential land use. This sort of conversion increases population densities, reduces the area of greenery, and results in less outside watering, hence, a smaller per capita use. This kind of development, which also occurs in Fresno, is not typical of the other areas studied.

In the city proper and harbor area, the trend of unit water use has been remarkably uniform for each month. The upward trend was disrupted in the early 1950's and during the past ten years has remained essentially unchanged. This pattern indicates that development within the area has become fairly steady. The lack of large seasonal fluctuations is due to the modifying influence of the coastal environment and to a strong industrial base with firm, unchanging water requirements.

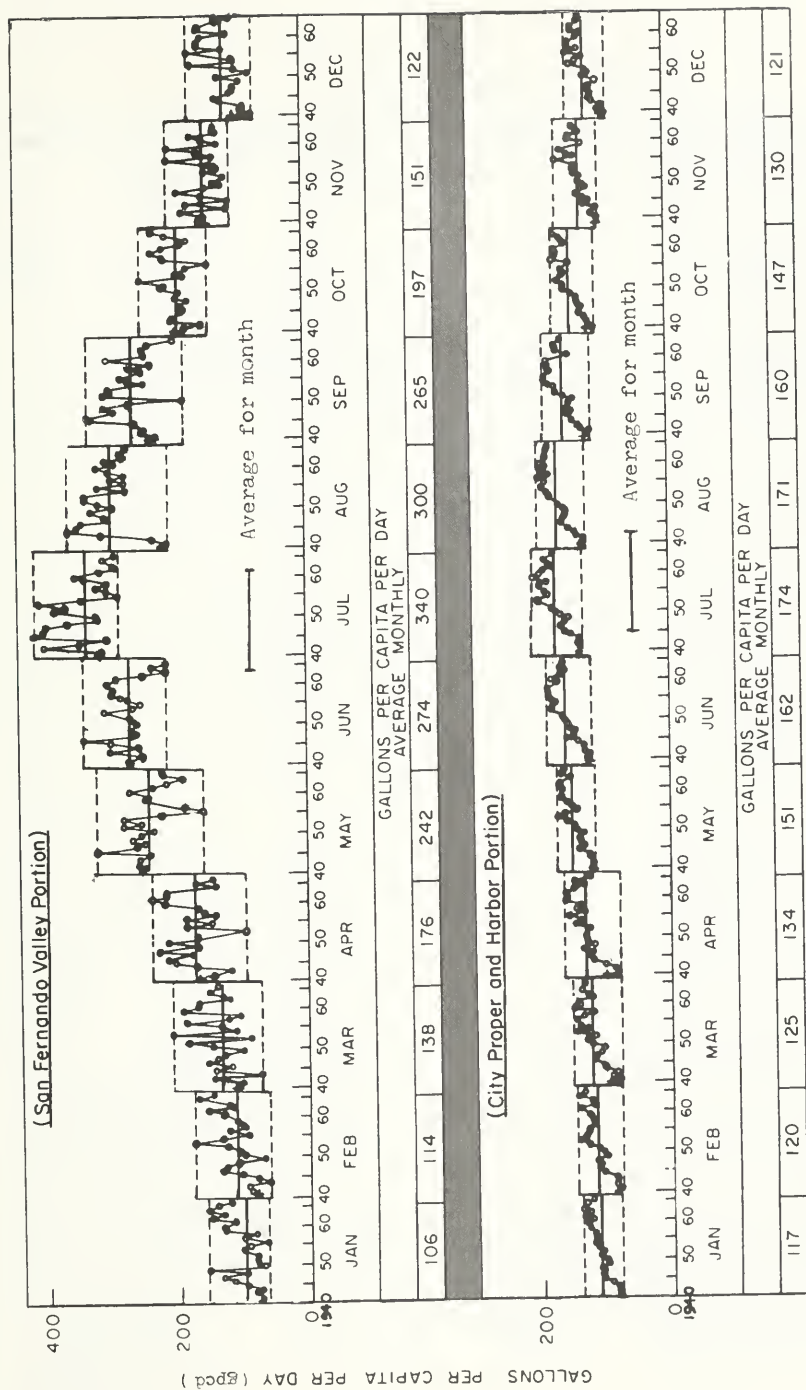


FIGURE 9f
YEARLY FLUCTUATIONS AND AVERAGES OF MONTHLY URBAN PER CAPITA WATER USE
LOS ANGELES, 1940-1965

Trends in Annual Values

Available long-term annual per capita water use values are presented in Table 11. The values generally pertain to cities, but values for a few water districts and metropolitan areas are also included. The locations of the cities and areas are shown on Figure 11.

At first glance, the historic urban unit water use values presented in Table 11 give the impression that per capita water use has increased generally over the past years. Further examination of these values, especially since 1950, confirms this for the North Coastal Area and the San Francisco Bay Area. Although no long-term values were obtained for the Sacramento River, Delta-Central Sierra, and San Joaquin Basins, an increasing trend in unit water use values is indicated in the data presented in Tables 12e, 12f, and 12g of Appendix C, which generally cover the years from 1961-1965. Further, these short-term records are supported by the 15 years of record for Merced in the San Joaquin Basin, which show an increasing trend.

On the other hand, a somewhat different picture is presented for the other areas where values were available. Of the 44 cities reported in Table 11 for the South Coastal Area, Central Coastal Area, and Tulare Lake Basin (excluding Hemet), approximately 10 percent show generally increasing unit values; about 30 percent exhibit generally decreasing values; and approximately 60 percent show little, if any, changing trend. Peak urban water use values were reached by approximately 80 percent of these cities between 1958 and 1962.

An example of a city that has shown surprisingly little change, especially in the last 15 years, is the city and harbor areas of Los Angeles. The average annual unit water use values have varied from 138 gpcd to only 167 gpcd, with a mean of about 158 gpcd during this period. The unit values for 12 years were within ± 5 percent of this mean value, and the maximum was only 9 percent.

Overall, these values cast some doubt on the widespread contention that per capita water use increases with population increase. This contention still may be valid when applied to certain components of urban complexes, such as residential areas and some industries, or to certain cities, but does not appear to be valid for many total urban complexes.

On the basis of the above analysis of the data presented in Table 11, the absence of clearly demonstrated widespread increases in per capita use during the past 15 years in the Central Coastal Area, South Coastal Area and Tulare Lake Basin support the use of the average per capita water use values compiled in this report for these areas.

LOCATION OF CITIES AND AREAS PROVIDING LONG-TERM ANNUAL DATA

INDEX TO COMMUNITIES AND AREAS SERVED

- | | |
|----------------------|-------------------------|
| 1. Arcata | 34. Ojai |
| 2. Eureka | 35. Ontario |
| 3. Ferndale | 36. Orange |
| 4. Fortuna | 37. Orland |
| 5. Garberville | 38. Pasadena |
| 6. Willits | 39. Pomona |
| 7. Eureka Bay | 40. Port Huene |
| 8. Marin | 41. Riverside |
| 9. San Francisco | 42. San Diego |
| 10. San Jose | 43. San Marcos |
| 11. Amoy Grande | 44. Santa Ana |
| 12. Atascadero | 45. Santa Monica |
| 13. Lompoc | 46. Santa Paula |
| 14. Paso Robles | 47. Salicoy |
| 15. San Luis Obispo | 48. Torrance |
| 16. Santa Barbara | 49. Ventura |
| 17. Santa Maria | 50. San Diego County |
| 18. Alhambra | Water Authority |
| 19. Anaheim | 51. Los Angeles Coastal |
| 20. Belmont | Plum Subunit |
| 21. Beverly Hills | 52. San Fernando Valley |
| 22. Burbank | Subunit |
| 23. Claremont | 53. San Gabriel Valley |
| 24. Compton | Subunit |
| 25. Fillmore | 54. Capital Los Angeles |
| 26. Fullerton | County |
| 27. Glendale | 55. South Bay Area |
| 28. Hemet | 56. Merced |
| 29. Long Beach | 57. Bakersfield |
| 30. Los Angeles | 58. Fresno |
| 31. Los Angeles | 59. Hanford |
| City Proper & Harbor | 60. Visalia |
| 32. Monterey Park | 61. San Bernardino |
| 33. Oceanside | |

HYDROGRAPHIC AREAS

- NC - NORTH COASTAL
 SF - SAN FRANCISCO BAY
 CC - CENTRAL COASTAL
 SC - SOUTH COASTAL
 SB - SACRAMENTO RIVER BASIN
 DC - DELTA-CENTRAL SIERRA BASIN
 SJ - SAN JOAQUIN RIVER BASIN
 TB - TULARE LAKE BASIN
 NL - NORTH LAHONTAN
 SL - SOUTH LAHONTAN
 CD - COLORADO DESERT

APPENDIX A

DEFINITION OF TERMS

APPENDIX A

Definitions of Terms

afpcy - acre feet per capita per year

Applied Water - Water delivered to a user. Also called delivered water. Applied water may be used for either inside uses or for outside watering. It does not include precipitation or distribution losses. It may apply to metered or unmetered deliveries.

Agency-Produced Water - Water pumped or diverted by private or public water agencies; excludes water produced by individuals or companies for self use.

Balanced Community - Several concepts of balance or average condition can prevail in a city or community among the four major types of land use (public facilities, residential, commercial, and industrial). The term may refer to a community with a percentage relationship between zoned or actual use areas of its four land uses that is similar to statewide averages, or it may refer to the average exchange of dollars between the major types of land use compared with statewide averages, or it may have other meanings. In this report a balanced community is one which, from all indications, would be expected to show the same general relationship of gross water use between the four major land use categories as do statewide averages. It does not apply, therefore, to communities with unusually high or low water use, such as might be found in recreational communities or communities with high-water-using industries.

Brackish Water - Sea water or any mixture of sea water and surface runoff which occurs in estuaries or at the lower reaches of streams that debouch into a bay or ocean or other highly mineralized water.

Census Boundaries - Either major portions of counties or small areas into which large cities and adjacent areas have been divided for statistical purposes. Such boundaries are established cooperatively by a local committee and the Bureau of Census and are generally designed to be relatively uniform with respect to population characteristics, economic status, and living conditions. In addition, boundaries are delineated so they seldom require change and can be easily located.

Commercial Establishment - Establishments providing services, engaged in the fabrication of structures or other fixed improvement, or otherwise occupied in nonmanufacturing profit-motivated activities. Examples are retail stores, apartment houses, restaurants, entertainment facilities, and home building concerns.

Commercial Water Use - Water used by a commercial establishment.

Consumptive Use (Urban) - Water transpired by urban-associated vegetative growth and used in building plant tissue; and water evaporated from soils, water surfaces, plant foliage, and impervious surfaces. It also includes water consumed inside homes, commercial establishments, and industrial establishments through evaporation in cooling, cleaning, and food preparation processes. It does not include irrecoverable losses. See also "Evapotranspiration".

Delivered Water - See "Applied Water".

Distribution Losses - See "Unaccountable Water".

Domestic Water Use - See "Residential Water Use".

Employee - Each person on the payroll of an operating manufacturing establishment for any duration.

Employee Working Days - The product of the average annual number of employees and working days.

Establishment - An economic unit which produces goods or services, such as a farm, a mine, a factory, or a store. In most instances, the establishment is at a single physical location, and is engaged in only one, or predominantly one, type of economic activity.

Evaporative Demand - The collective influence of all climatic factors on the rate of evaporation of water.

Evapotranspiration - The quantity of water transpired by plants; retained in plant tissue; and evaporated from plant foliage, from surrounding surfaces, and from adjacent soil, in a specified time period. Usually expressed in depth of water per unit area. As used in this report, evapotranspiration refers to outside consumptive use.

External Water Use - See "Outside Water Use".

Flat Rate Water - Water sold to customers at a fixed rate irrespective of quantity used.

Fragmentation - An urban area which develops in a scattered or fragmented manner rather than in a uniform manner from existing urban land uses. Also called "Urban Sprawl".

gpcd - gallons per capita per day.

Greenbelts or Greenbelt Parks - Open space areas, which may consist of agricultural lands, forests, reservoirs, park lands, etc., which encircle or border a community. The purpose of greenbelting is to insure that such open areas are protected from encroaching growth and development and, at the same time to help control the physical sprawl of an area.

HA - Hydrographic Area

Household Water Use - All water used within a home for other than personal hygiene and drinking.

Industrial Establishment - An establishment engaged in the mechanical or chemical transformation of inorganic or organic substances into new products, and usually described as plants, factories, or mills, which characteristically use power-driven machines and materials-handling equipment. Establishments engaged in assembling component parts of manufactured products are also considered manufacturing if the new product is neither a structure nor other fixed improvement.

Industrial Water Use - Water used by an industrial establishment.

Inside Water Use - That part of the water delivery used within a home, commercial establishment, or manufacturing establishment for any purpose; also called "Internal Water Use".

Internal Water Use - See "Inside Water Use".

Irrecoverable Water - That portion of delivered water degraded physically or chemically to a level that makes it uneconomical to reclaim, and water discharged directly to the ocean or some other land or water body where it no longer is recoverable.

Manufacturing Establishment - See "Industrial Establishment".

Metered Water - Water sold to customers on the basis of actual measured use; does not include losses in distribution.

Multiple-family Residential Use - A commercial type of establishment including motels, apartments, condominiums, hotels, etc.; residential uses other than single-family dwellings and duplexes.

Municipal and Industrial Water Use (M&I) - See "Urban Water Use" and also "Water Produced".

Net Water Use (Urban) - The sum of delivered water consumptively used and irrecoverably lost.

Outside Water Use - The use of water for irrigation of gardens, lawns, and ornamental shrubs, and for replenishing swimming pools, car washing, etc.; also called "External Water Use".

Personal Water Use - All water used within the home for personal hygiene and drinking.

Persons Per Connection (ppc) - A factor obtained by dividing the total population of a water service area by the sum of residential, commercial, industrial, and miscellaneous water connections. In certain instances, electrical or sewage connections may be used.

ppc - persons per connection

Precipitation - The total measurable supply of water of all forms of falling moisture, including dew, rain, mist, snow, hail, and sleet; usually expressed as depth of liquid water on a horizontal surface on a daily, monthly, or yearly basis.

Private, Industry-Produced Water - Privately produced water used by industries; may include fresh or brackish water.

Privately Produced Water - Water pumped or diverted by an individual or company for self use; excludes agency-produced water.

Public Facilities - All structures, parks, and public places, other than recreational areas, engaged either in serving the public or in providing a public use.

Public Water Use - Water use associated with public facilities.

Recycling - See "Second-Cycle Growth".

Recreational Area - An area predominately occupied or used on an intermittent basis (e.g., weekends or during the summer) for leisure and/or recreational purposes. Excludes public facilities fitting this definition located outside recreational areas.

Residential Area - In this report, refers to urban areas occupied by single-family dwellings and duplexes.

Residential Water Use - All inside and outside uses of water associated with residential areas.

Second-Cycle Growth - The redevelopment of existing built-up urban areas, or the second time land has been developed for urban uses. Second-cycle growth is usually at higher intensities than first-cycle development. It is also called "Recycling" and "Urban Renewal".

Service Area - The area of land included in the distribution system of an agency.

Sewage - In this report, waste water from sewage treatment facilities; does not include storm and surface waters.

Type of Water Use - A distinction of water use based on either a kind of land use (recreational, residential, commercial, etc.) or on a kind of water use (outside use, personal use, swimming pool use, dishwashing, etc.).

Unaccountable Water - The difference between the quantity of water introduced into the system and the quantity delivered to the eventual consumer; usually expressed as a percentage of delivered water. Many local factors affect this percentage from system to system, but in general, about 10 percent is considered indicative of good management and good conservation practices. See "Water Production and Use Measurements", Chapter II for a list of the important factors.

Unit Water Use (Unit Value of Water Use) - The average quantity of water used per person, acre, etc., over a specified period of time.

Urban Per Capita Water Use - A unit value of water use which encompasses all urban uses of water in a service area.

Urban Renewal - See "Second-Cycle Growth".

Urban Sprawl - Development without clear-cut visual delineations among communities. See also "Fragmentation".

Urban Water Use - The use of water for urban purposes, including residential, commercial, industrial, recreational, military, and institutional classes. The term is applied in the sense that it is a kind of use rather than a place of use. Includes delivered water and unaccountable water. See also "Water Produced".

Water Agency - An agency organized, founded, or established to produce and distribute water directly or indirectly to customers; the two major types are privately owned companies and publicly owned companies. Private companies consist of commercial companies and mutual water groups; public companies consist of water districts and municipally owned water departments.

Water Produced - The total water into the system or the sum of applied water and unaccountable water; also called "Urban Water Use".

Water-Using Plant Area - The portion of a plant, usually in square feet, in which intake water may be used for any purpose and wherein water may be developed, treated, recircultaed, and discharged. It does not include parking, storage, or idle space on the premises, or plant areas in which water has no function.

APPENDIX B

SOURCES OF DATA

APPENDIX B

Sources of Data

The unit values presented in this report have been computed from measured quantities of water produced and estimated numbers of people served.

Water Use Data

Much of the work done under the M&I Water Use program consists of compiling and analyzing water use data from a number of public and private water agencies. Most of the data in this report have been obtained in this manner. Where data were voluminous and awkward to transcribe by hand, records were microfilmed and reproduced for editing later. Where it was impractical to deal directly with a water agency, published reports have been relied on for data.

The State Public Utilities Commission (PUC) reports are a prime source of data on water produced by commercial agencies because of a state regulation requiring each commercial water agency operating in California to submit an annual report to the Commission. Although the main purpose of the reports is to obtain an accounting of commercial water agencies' fiscal operations, physical and statistical data relating to the system are also included.

It is legally required that all commercial agencies report water they produce. However, the quality and completeness of the data vary considerably. Most of the PUC data used in this bulletin came from those companies with the most complete records.

The State Controller publishes an annual report containing information from each incorporated municipality in California. Those cities operating a water service are asked to report data on financial, physical, and operational activities and other data concerning their system. The report is similar in some respects to the reports submitted to the Public Utilities Commission by commercial water agencies. However, it does not contain monthly data, only annual summaries. Because they do not show monthly water use, these data have been used only for evaluating annual water use trends. The records are fairly complete for the Los Angeles and San Francisco Bay areas, where most water is sold on a metered basis.

Generally, the large municipal water departments, commercial water service agencies, and several large water districts have the most complete, reliable, and detailed information

relating to water production and distribution. Since most of the State's population is served from these sources, unit values of use developed from them have wide application.

Mutual water companies and most special districts serving water are not required to report water use data to any central agency. However, they often can provide such data. Some limited data of this kind appear in this bulletin.

Although not used in this report, other sources of water use information include State Health Department reports, United States Public Health Service records, and United States Geological Survey reports.

Population Data

Average annual and/or monthly populations within areas served by water agencies were obtained either from the reporting agencies or the reports they submit. Where values were not available from these sources, they were determined by using a variety of methods that generally may be grouped under the two activities: data interpretation and use of a factor.

In general, the interpretation techniques, consisting of interpolating or extrapolating available population data, gave results which were the least satisfactory and were used only (1) where population could not be easily determined by factoring and (2) where service area boundaries coincided with U. S. Census boundaries. The use of census populations permitted values between 1950 and 1960 census years to be interpolated and for years subsequent to 1960 to be extrapolated.

Because interpolation or extrapolation of the population values in particular years would not detect any unusual population changes such as might accompany the addition of a new industry or college campus, or, conversely, the closing of such facilities, checks were made in the communities to determine such possibilities. Such checks resulted in a number of adjustments to these values.

The method most widely used for determining populations was the use of a factor. This method consisted of multiplying the number of water, sewer, or electrical connections (indicators of population) by a factor relating population to number of connections determined for a census year. This factor is called persons per connection and is abbreviated ppc. Although any kind of connection may be used that tends to increase proportionately with the population, water connections were most commonly used.

Because ppc factors do not always remain constant, factors between regular and special census years were normally interpolated and, for other years, extrapolated.

Data for determining ppc factors were usually given by the water agencies as either number of connections or number of accounts. Number of accounts were not used unless evaluated because a single account, such as an apartment house, could include many water connections.

In water service areas where census boundaries and agency boundaries did not coincide, population determinations became more complicated. Under such circumstances, data on the number of people outside the population unit were obtained by determining the number of connections in the outside area and multiplying by the factor used inside the population unit. The number of outside connections was usually obtained from the water agency. However, in portions of Modesto and Ceres where such information was not available, they were obtained from recent aerial photographs. This approach was used because the area was entirely residential and each home was known to represent one connection. Also, the photographs showed current use and permitted a rapid count of the connections.

Although it is highly impractical and economically unfeasible to determine the exact average population of a water service area for any given year, the various methods described give values that are reliable and quite adequate for most water development planning.

APPENDIX C

MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER

TABLE 12a
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

| County City | Agency (Name and Type) | Year of Record | Annual Water Into System (million gals.) | Estimated Average Population Served | Average Daily Water Use | | | | | | | | | | | | Total | |
|----------------|--|-------------------|---|--|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------|-------|
| | | | | | Monthly (gpcd) | | | | | | | | | | | | Annually | |
| | | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | gpcd | afpy |
| DEL NORTE | | | | | | | | | | | | | | | | | | |
| Crescent City | -MWD | 1966 | 252 | 5,000 | 165 | 143 | 106 | 133 | 151 | 158 | 150 | 157 | 147 | 112 | 87 | 147 | 138 | 1,154 |
| HUMBOLDT | | | | | | | | | | | | | | | | | | |
| Arcata | -MWD | 1963 | - | 8,800 | - | - | - | 94 | 103 | 114 | 131 | 136 | 206 | 98 | 95 | 97 | - | - |
| | | 1964 | 343 | 9,000 | 97 | 100 | 95 | 106 | 109 | 105 | 106 | 105 | 114 | 110 | 101 | 99 | 104 | 1,116 |
| | | 1965 | 353 | 9,400 | 92 | 87 | 99 | 93 | 111 | 110 | 124 | 117 | 109 | 100 | 92 | 88 | 102 | 1,114 |
| | | 1966 | 374 | 9,600 | 87 | 82 | 87 | 93 | 127 | 130 | 125 | 119 | 111 | 99 | 95 | 87 | 104 | 1,116 |
| Eureka | -MWD & Humboldt Community Service District (CSD) | 1962 | - | 35,000 | - | - | - | - | - | - | 161 | 136 | 122 | 105 | 104 | 103 | - | - |
| | | 1963 | 1,558 | 36,000 | 109 | 103 | 105 | 108 | 111 | 155 | 162 | 142 | 136 | 112 | 110 | 108 | 122 | 1,337 |
| | | 1964 | 1,704 | 37,500 | 102 | 110 | 109 | 116 | 124 | 141 | 149 | 147 | 147 | 124 | 110 | 112 | 124 | 1,339 |
| | | 1965 | 1,880 | 38,300 | 123 | 117 | 119 | 120 | 138 | 161 | 186 | 160 | 122 | 139 | 110 | 117 | 135 | 1,351 |
| | | 1966 | 1,879 | 39,300 | 112 | 121 | 121 | 126 | 142 | 187 | 175 | 170 | 121 | 102 | 95 | 101 | 131 | 1,417 |
| Garberville | Garberville Water Co., Inc. (CWC) | 1962 | 39 | 1,100 | 69 | 76 | 73 | 85 | 85 | 154 | 152 | 141 | 123 | 75 | 76 | 67 | 98 | 1,110 |
| | | 1963 | 39 | 1,100 | 72 | 81 | 71 | 71 | 85 | 137 | 155 | 162 | 116 | 81 | 77 | 60 | 97 | 1,099 |
| | | 1964 | 38 | 1,100 | 68 | 73 | 60 | 76 | 83 | 100 | 167 | 149 | 122 | 102 | 71 | 73 | 95 | 1,066 |
| MENDOCINO | | | | | | | | | | | | | | | | | | |
| Fort Bragg | -MWD | 1961 | 183 | 5,196 | 78 | 89 | 86 | 86 | 85 | 121 | 132 | 115 | 108 | 91 | 83 | 84 | 97 | 1,019 |
| | | 1962 | 179 | 5,216 | 81 | 78 | 80 | 86 | 106 | 138 | 124 | 106 | 100 | 77 | 74 | 75 | 94 | 1,015 |
| | | 1963 | 204 | 5,251 | 80 | 82 | 83 | 87 | 109 | 144 | 157 | 146 | 125 | 93 | 87 | 84 | 106 | 1,119 |
| | | 1964 | 214 | 5,394 | 81 | 82 | 84 | 105 | 108 | 134 | 157 | 149 | 123 | 104 | 83 | 86 | 108 | 1,121 |
| | | 1965 | 216 | 5,541 | 88 | 89 | 89 | 86 | 120 | 141 | 143 | 138 | 120 | 97 | 86 | 86 | 107 | 1,120 |
| Orish | -MWD | 1961 | 714 | 9,641 | 109 | 108 | 109 | 148 | 166 | 348 | 402 | 358 | 277 | 181 | 113 | 107 | 202 | 2,266 |
| | | 1962 | 704 | 9,712 | 102 | 102 | 102 | 175 | 214 | 338 | 381 | 347 | 246 | 145 | 118 | 101 | 148 | 2,222 |
| | | 1963 | 659 | 9,853 | 101 | 97 | 101 | 103 | 156 | 316 | 349 | 336 | 258 | 136 | 110 | 123 | 182 | 2,204 |
| | | 1964 | 783 | 9,909 | 120 | 122 | 126 | 190 | 228 | 316 | 383 | 371 | 286 | 211 | 117 | 117 | 216 | 2,242 |
| | | 1965 | 789 | 10,099 | 117 | 120 | 129 | 131 | 263 | 330 | 388 | 337 | 291 | 200 | 128 | 128 | 214 | 2,240 |
| SONOMA | | | | | | | | | | | | | | | | | | |
| Santa Rosa | -MWD | 1961 | 2,008 | 38,171 | 101 | 102 | 102 | 133 | 159 | 228 | 255 | 223 | 189 | 158 | 125 | 118 | 158 | 1,777 |
| | | 1962 | 2,656 | 39,322 | 105 | 106 | 100 | 160 | 202 | 241 | 234 | 227 | 183 | 124 | 111 | 101 | 158 | 1,777 |
| | | 1963 | 2,236 | 40,849 | 104 | 103 | 100 | 102 | 132 | 217 | 249 | 249 | 199 | 125 | 112 | 112 | 150 | 1,668 |
| | | 1964 | 2,760 | 43,208 | 106 | 120 | 116 | 163 | 184 | 218 | 265 | 261 | 238 | 194 | 127 | 102 | 175 | 1,796 |
| | | 1965 | 2,875 | 45,507 | 101 | 112 | 75 | 113 | 191 | 210 | 230 | 224 | 212 | 158 | 139 | 99 | 155 | 1,774 |

* Refer to last page of Appendix O for abbreviations.

TABLE 12D
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

| County City | Agency (Name and Type)* | Year of Record | Annual Water Into System, million gal. | Estimated Average Population Served | Average Daily Water Use | | | | | | | | | | | | Total annually gpcd | Total annually afpy |
|-------------------|---|----------------------|---|--|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------------------------|---------------------------|
| | | | | | Monthly (gpcd) | | | | | | | | | | | | | |
| | | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| ALAMEDA | | | | | | | | | | | | | | | | | | |
| Alameda | East Bay MUD | 1961 | 2,990 | 63,855 | - | - | - | - | - | - | - | - | - | - | - | - | 128 | 130 |
| | | 1962 | 2,737 | 63,855 | - | - | - | - | - | - | - | - | - | - | - | - | 120 | 134 |
| | | 1963 | 2,727 | 63,855 | - | - | - | - | - | - | - | - | - | - | - | - | 117 | 131 |
| | | 1964 | 2,950 | 71,000 | - | - | - | - | - | - | - | - | - | - | - | - | 115 | 129 |
| | | 1965 | 3,592 | 73,300 | - | - | - | - | - | - | - | - | - | - | - | - | 138 | 155 |
| Berkeley | East Bay MUD | 1961 | 5,686 | 111,268 | - | - | - | - | - | - | - | - | - | - | - | - | 140 | 157 |
| | | 1962 | 5,523 | 111,268 | - | - | - | - | - | - | - | - | - | - | - | - | 136 | 152 |
| | | 1963 | 5,565 | 111,268 | - | - | - | - | - | - | - | - | - | - | - | - | 137 | 153 |
| | | 1964 | 6,191 | 120,300 | - | - | - | - | - | - | - | - | - | - | - | - | 141 | 158 |
| | | 1965 | 6,411 | 120,300 | - | - | - | - | - | - | - | - | - | - | - | - | 146 | 164 |
| Livermore | Cal. Water Service Co. (CWC) | 1961 | 977 | 13,649 | 76 | 80 | 86 | 139 | 145 | 217 | 243 | 202 | 165 | 143 | 100 | 70 | 139 | 156 |
| | | 1962 | 1,028 | 21,013 | 81 | 73 | 77 | 149 | 177 | 212 | 222 | 201 | 167 | 98 | 90 | 74 | 135 | 151 |
| | | 1963 | 970 | 22,498 | 79 | 79 | 88 | 78 | 137 | 202 | 222 | 164 | 172 | 79 | 94 | 74 | 119 | 133 |
| | | 1964 | 1,230 | 23,785 | 76 | 99 | 95 | 190 | 177 | 186 | 228 | 220 | 183 | 146 | 76 | 69 | 142 | 159 |
| | | 1965 | 1,333 | 25,642 | 74 | 82 | 78 | 89 | 135 | 195 | 220 | 227 | 232 | 163 | 141 | 78 | 143 | 160 |
| Oakland | East Bay MUD | 1961 | 18,111 | 367,948 | - | - | - | - | - | - | - | - | - | - | - | - | 135 | 151 |
| | | 1962 | 17,977 | 367,948 | - | - | - | - | - | - | - | - | - | - | - | - | 134 | 150 |
| | | 1963 | 17,443 | 367,999 | - | - | - | - | - | - | - | - | - | - | - | - | 130 | 146 |
| | | 1964 | 18,161 | 385,700 | - | - | - | - | - | - | - | - | - | - | - | - | 129 | 144 |
| | | 1965 | 18,724 | 385,700 | - | - | - | - | - | - | - | - | - | - | - | - | 133 | 149 |
| Pleasanton | Pleasanton Township CWB | 1964 | 364 | 5,850 | 94 | 107 | 106 | 156 | 185 | 218 | 263 | 247 | 229 | 203 | 108 | 121 | 170 | 190 |
| | | 1965 | 411 | 6,200 | 96 | 107 | 124 | 122 | 222 | 245 | 285 | 270 | 234 | 214 | 134 | 117 | 181 | 203 |
| | | 1966 | 342 | 7,925 | 94 | 98 | 128 | 188 | 227 | 261 | 266 | 286 | 249 | 222 | 133 | 118 | 189 | 212 |
| San Leandro | East Bay MUD | 1961 | 3,587 | 65,962 | - | - | - | - | - | - | - | - | - | - | - | - | 149 | 167 |
| | | 1962 | 3,611 | 65,962 | - | - | - | - | - | - | - | - | - | - | - | - | 150 | 168 |
| | | 1963 | 3,323 | 65,962 | - | - | - | - | - | - | - | - | - | - | - | - | 138 | 155 |
| | | 1964 | 4,115 | 69,600 | - | - | - | - | - | - | - | - | - | - | - | - | 162 | 181 |
| | | 1965 | 4,192 | 69,600 | - | - | - | - | - | - | - | - | - | - | - | - | 165 | 185 |
| San Ramon Village | Valley Community Services District (CSD) | 1962 | 144 | 4,075 | 58 | 67 | 49 | 94 | 114 | 141 | 162 | 129 | 104 | 95 | 69 | 67 | 97 | 109 |
| | | 1963 | 226 | 5,779 | 70 | 73 | 69 | 61 | 100 | 146 | 160 | 158 | 145 | 103 | 74 | 68 | 104 | 116 |
| | | 1964 | 425 | 9,273 | 67 | 81 | 81 | 127 | 147 | 168 | 207 | 178 | 160 | 136 | 68 | 64 | 125 | 140 |
| | | 1965 | 526 | 11,992 | 71 | 72 | 69 | 78 | 155 | 172 | 190 | 179 | 158 | 133 | 86 | 66 | 120 | 134 |
| S. E. Bay Area | Alameda CWD | 1961 | 2,635 | 61,184 | - | - | - | - | - | - | - | - | - | - | - | - | 118 | 132 |
| | | 1962 | 3,065 | 71,152 | - | - | - | - | - | - | - | - | - | - | - | - | 118 | 132 |
| | | 1963 | 3,720 | 81,536 | - | - | - | - | - | - | - | - | - | - | - | - | 125 | 140 |
| | | 1964 | 4,524 | 93,196 | - | - | - | - | - | - | - | - | - | - | - | - | 133 | 149 |
| | | 1965 | 5,033 | 99,926 | - | - | - | - | - | - | 188 | 177 | 161 | 143 | 98 | 90 | 138 | 155 |
| | | 1966 | 5,581 | 106,182 | 95 | 98 | 111 | 155 | 191 | 207 | 190 | 191 | 170 | 144 | 95 | 86 | 144 | 161 |
| SOUTH COAST | | | | | | | | | | | | | | | | | | |
| Antioch | MWD | 1962 | 1,309 | 18,776 | 92 | 92 | 104 | 192 | 246 | 272 | 234 | 310 | 332 | 200 | 109 | 98 | 191 | 214 |
| | | 1963 | 1,318 | 19,790 | 97 | 95 | 102 | 198 | 198 | 279 | 245 | 285 | 349 | 215 | 108 | 104 | 182 | 204 |
| | | 1964 | 1,472 | 20,202 | 88 | 107 | 115 | 197 | 229 | 242 | 246 | 326 | 325 | 253 | 91 | 90 | 193 | 216 |
| | | 1965 | 1,396 | 22,348 | 85 | 91 | 101 | 120 | 204 | 217 | 240 | 247 | 316 | 248 | 108 | 93 | 172 | 193 |
| Martinez | MWD | 1962 | 790 | 13,851 | 94 | 90 | 99 | 148 | 181 | 211 | 196 | 296 | 240 | 163 | 100 | 94 | 156 | 175 |
| | | 1963 | 835 | 14,530 | 92 | 90 | 94 | 105 | 156 | 210 | 207 | 259 | 253 | 205 | 107 | 103 | 157 | 176 |
| | | 1964 | 1,024 | 15,373 | 99 | 108 | 114 | 179 | 202 | 215 | 224 | 280 | 280 | 253 | 115 | 109 | 182 | 204 |
| | | 1965 | 1,082 | 15,950 | 104 | 100 | 120 | 126 | 217 | 225 | 239 | 297 | 286 | 254 | 134 | 119 | 185 | 207 |
| 1966 | 1,273 | 19,455 | 92 | 96 | 117 | 175 | 217 | 250 | 227 | 282 | 237 | 214 | 110 | 114 | 179 | 200 | | |

* Refer to last page of Appendix C for abbreviations.

TABLE 12b
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

| County City | Agency (Name and Type)* | Year of Record | Annual Water Into System (million gals.) | Estimated Average Population Served | Average Daily Water Use Monthly (gpcd) | | | | | | | | | | | | Total | |
|--------------------|----------------------------|-------------------|---|--|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|-------|
| | | | | | | | | | | | | | | | | | gpcd | afpcy |
| | | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| CONTRA COSTA | | | | | | | | | | | | | | | | | | |
| Pittsburg | -MWD | 1961 | 984 | 19,063 | 104 | 81 | 81 | 137 | 133 | 186 | 220 | 201 | 176 | 152 | 129 | 91 | 141 | 158 |
| | | 1962 | 906 | 19,050 | 97 | 84 | 90 | 130 | 151 | 185 | 193 | 187 | 158 | 103 | 99 | 81 | 130 | 146 |
| | | 1963 | 860 | 19,800 | 81 | 82 | 86 | 81 | 118 | 159 | 184 | 193 | 156 | 116 | 88 | 80 | 119 | 133 |
| | | 1964 | 1,076 | 20,900 | 74 | 94 | 102 | 141 | 158 | 173 | 209 | 202 | 173 | 156 | 108 | 99 | 141 | 158 |
| | | 1965 | 1,047 | 20,900 | 94 | 98 | 101 | 109 | 167 | 172 | 199 | 196 | 167 | 146 | 101 | 93 | 137 | 153 |
| | | | | | | | | | | | | | | | | | | |
| Richmond | East Bay MWD | 1961 | 9,625 | 71,854 | - | - | - | - | - | - | - | - | - | - | - | - | 367 | 441 |
| | | 1962 | 9,494 | 71,854 | - | - | - | - | - | - | - | - | - | - | - | - | 362 | 440 |
| | | 1963 | 9,747 | 76,300 | - | - | - | - | - | - | - | - | - | - | - | - | 390 | 392 |
| | | 1964 | 10,806 | 79,800 | - | - | - | - | - | - | - | - | - | - | - | - | 371 | 416 |
| | | 1965 | 11,246 | 80,450 | - | - | - | - | - | - | - | - | - | - | - | - | 383 | 429 |
| | | | | | | | | | | | | | | | | | | |
| Walnut Creek | East Bay MWD | 1961 | 618 | 9,903 | - | - | - | - | - | - | - | - | - | - | - | - | 171 | 192 |
| | | 1962 | 700 | 10,197 | - | - | - | - | - | - | - | - | - | - | - | - | 186 | 211 |
| | | 1963 | 790 | 10,320 | - | - | - | - | - | - | - | - | - | - | - | - | 199 | 223 |
| | | 1964 | 1,092 | 15,668 | - | - | - | - | - | - | - | - | - | - | - | - | 184 | 206 |
| MARIN | | | | | | | | | | | | | | | | | | |
| North Marin Cities | North Marin CWD | 1961 | 658 | 17,760 | 59 | 60 | 60 | 87 | 109 | 159 | 186 | 126 | 117 | 106 | 81 | 66 | 101 | 113 |
| | | 1962 | 880 | 18,711 | 56 | 65 | 70 | 141 | 155 | 181 | 196 | 265 | 163 | 100 | 78 | 70 | 128 | 143 |
| | | 1963 | 860 | 20,061 | 65 | 72 | 73 | 67 | 116 | 200 | 212 | 190 | 171 | 93 | 73 | 73 | 117 | 131 |
| | | 1964 | 1,081 | 21,593 | 73 | 77 | 85 | 132 | 154 | 172 | 211 | 215 | 196 | 158 | 88 | 78 | 137 | 153 |
| | | 1965 | 1,220 | 24,483 | 76 | 84 | 84 | 88 | 180 | 200 | 205 | 208 | 174 | 151 | 92 | 75 | 135 | 151 |
| | | | | | | | | | | | | | | | | | | |
| South Marin Cities | Marin MWD | 1961 | 7,068 | 129,000 | 93 | 89 | 96 | 129 | 160 | 213 | 232 | 203 | 187 | 158 | 127 | 108 | 150 | 168 |
| | | 1962 | 7,836 | 135,000 | 105 | 109 | 120 | 164 | 194 | 226 | 225 | 217 | 192 | 132 | 122 | 112 | 160 | 179 |
| | | 1963 | 8,493 | 141,000 | 117 | 110 | 112 | 104 | 143 | 215 | 205 | 216 | 191 | 127 | 104 | 96 | 145 | 162 |
| | | 1964 | 8,055 | 148,000 | 94 | 112 | 114 | 148 | 166 | 178 | 215 | 213 | 195 | 160 | 96 | 94 | 149 | 167 |
| | | 1965 | 8,207 | 153,000 | 96 | 104 | 110 | 108 | 180 | 197 | 211 | 200 | 184 | 169 | 107 | 97 | 147 | 165 |
| NAPA | | | | | | | | | | | | | | | | | | |
| Calistoga | -MWD | 1961 | 175 | 1,841 | 130 | 132 | 996 | 330 | 232 | 296 | 344 | 290 | 263 | 208 | 137 | 148 | 259 | 290 |
| | | 1962 | 173 | 1,915 | 137 | 138 | 437 | 206 | 260 | 342 | 349 | 354 | 260 | 157 | 164 | 161 | 247 | 277 |
| | | 1963 | 146 | 1,320 | 157 | 164 | 199 | 147 | 152 | 243 | 309 | 316 | 260 | 188 | 181 | 180 | 208 | 233 |
| | | 1964 | 126 | 1,228 | 187 | 190 | 187 | 147 | 155 | 198 | 261 | 236 | 195 | 163 | 105 | 109 | 178 | 199 |
| | | 1965 | 134 | 1,967 | 178 | 244 | 94 | 87 | 173 | 202 | 262 | 240 | 275 | 196 | 195 | 185 | 188 | 211 |
| | | | | | | | | | | | | | | | | | | |
| Napa | -MWD | 1964 | 2,409 | 40,287 | 135 | 130 | 129 | 143 | 207 | 228 | 248 | 259 | 232 | 205 | 139 | 124 | 181 | 203 |
| | | 1965 | 2,841 | 41,524 | 118 | 125 | 125 | 123 | 170 | 239 | 242 | 250 | 240 | 181 | 121 | 116 | 171 | 192 |
| | | | | | | | | | | | | | | | | | | |
| SAN FRANCISCO | | | | | | | | | | | | | | | | | | |
| San Francisco | -MWD | 1960-61 | 33,452 | 744,000 | 135 | 134 | 132 | 123 | 114 | 109 | 113 | 110 | 115 | 121 | 129 | 132 | 123 | 138 |
| | | 1961-62 | 32,806 | 746,000 | 132 | 131 | 129 | 121 | 111 | 106 | 111 | 112 | 112 | 119 | 126 | 136 | 120 | 134 |
| | | 1962-63 | 32,018 | 746,000 | 127 | 127 | 126 | 118 | 109 | 104 | 108 | 107 | 110 | 116 | 124 | 133 | 118 | 132 |
| | | 1963-64 | 34,978 | 744,000 | 141 | 140 | 138 | 129 | 119 | 114 | 118 | 119 | 120 | 127 | 135 | 146 | 129 | 145 |
| | | 1964-65 | 36,088 | 743,000 | 146 | 144 | 143 | 133 | 123 | 118 | 122 | 119 | 124 | 131 | 140 | 151 | 133 | 147 |
| | | | | | | | | | | | | | | | | | | |
| SANTA CLARA | | | | | | | | | | | | | | | | | | |
| Mountain View | -MWD | 1961 | 1,585 | 33,300 | 84 | 83 | 93 | 129 | 139 | 175 | 185 | 168 | 156 | 136 | 106 | 85 | 185 | 143 |
| | | 1962 | 1,744 | 36,000 | 86 | 81 | 88 | 142 | 162 | 177 | 182 | 184 | 160 | 118 | 110 | 98 | 184 | 148 |
| | | 1963 | 1,873 | 40,500 | 86 | 89 | 98 | 91 | 130 | 176 | 186 | 180 | 159 | 124 | 105 | 93 | 186 | 141 |
| | | 1964 | 2,214 | 43,800 | 99 | 112 | 115 | 146 | 156 | 161 | 184 | 179 | 163 | 144 | 101 | 97 | 184 | 151 |
| | | 1965 | 2,481 | 46,800 | 98 | 105 | 123 | 118 | 175 | 183 | 190 | 186 | 173 | 160 | 118 | 110 | 186 | 162 |
| | | | | | | | | | | | | | | | | | | |
| Palo Alto | -MWD | 1961 | 4,275 | 56,529 | 127 | 146 | 132 | 175 | 204 | 246 | 309 | 298 | 287 | 217 | 175 | 133 | 204 | 228 |
| | | 1962 | 4,333 | 56,932 | 121 | 158 | 125 | 180 | 255 | 285 | 314 | 277 | 274 | 222 | 156 | 133 | 208 | 233 |
| | | 1963 | 4,009 | 57,281 | 128 | 137 | 136 | 137 | 139 | 240 | 295 | 293 | 277 | 227 | 151 | 134 | 191 | 214 |
| | | 1964 | 4,602 | 58,344 | 131 | 146 | 167 | 195 | 228 | 243 | 299 | 300 | 291 | 247 | 180 | 131 | 213 | 239 |
| | | 1965 | 4,622 | 58,652 | 130 | 154 | 146 | 165 | 201 | 298 | 291 | 302 | 290 | 249 | 220 | 134 | 216 | 242 |

* Refer to last page of Appendix C for abbreviations.

TABLE 129
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

| County City | Agency (Name and Type)* | Year of Record | Annual Water Into System (Million Gals) | Estimated Average Population Served | Average Daily Water Use Monthly (gpcd) | | | | | | | | | | | | Total | |
|--------------------------------|---------------------------------|----------------------|--|--|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|------|
| | | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | gpcd | afpy |
| SANTA CLARA San Jose | San Jose (City Works) | 1961 | 20,038 | 351,288 | - | - | - | - | - | - | - | - | - | - | - | - | 156 | .175 |
| | | 1962 | 21,064 | 372,386 | - | - | - | - | - | - | - | - | - | - | - | - | - | .161 |
| | | 1963 | 21,531 | 404,571 | 100 | 94 | 100 | 95 | 153 | 221 | 237 | 233 | 196 | 131 | 93 | 93 | 146 | .164 |
| | | 1964 | 25,119 | 432,589 | 95 | 106 | 111 | 162 | 182 | 205 | 244 | 235 | 215 | 169 | 97 | 89 | 159 | .178 |
| | | 1965 | 25,531 | 449,931 | 88 | 97 | 116 | 115 | 199 | 216 | 233 | 226 | 203 | 168 | 106 | 93 | 155 | .174 |
| Sunnyvale | -MWD | 1963 | 3,551 | 74,231 | 94 | 92 | 99 | 91 | 134 | 193 | 201 | 200 | 165 | 118 | 90 | 88 | 130 | .146 |
| | | 1964 | 4,214 | 79,217 | 92 | 107 | 114 | 145 | 161 | 172 | 204 | 210 | 194 | 147 | 86 | 92 | 145 | .162 |
| | | 1965 | 4,315 | 81,826 | 89 | 99 | 115 | 110 | 182 | 196 | 203 | 203 | 184 | 151 | 102 | 90 | 144 | .161 |
| SAN MATEO Belmont | -CWD | 1961 | 804 | 17,000 | 73 | 100 | 104 | 117 | 123 | 137 | 182 | 157 | 141 | 138 | 100 | 92 | 130 | .146 |
| | | 1962 | 844 | 16,504 | 88 | 84 | 106 | 147 | 147 | 162 | 148 | 151 | 145 | 101 | 96 | 84 | 124 | .132 |
| | | 1963 | 862 | 20,000 | 88 | 102 | 91 | 92 | 126 | 162 | 164 | 156 | 137 | 105 | 82 | 81 | 118 | .138 |
| | | 1964 | 971 | 22,000 | 93 | 103 | 109 | 126 | 129 | 166 | 151 | 148 | 154 | 107 | 86 | 88 | 121 | .136 |
| | | 1965 | 985 | 23,000 | 77 | 81 | 91 | 105 | 137 | 155 | 141 | 146 | 134 | 112 | 88 | 60 | 112 | .125 |
| Halfmoon Bay Cities | Coastside CWD | 1961 | - | 3,927 | 65 | 81 | 62 | 85 | 85 | 72 | 110 | 99 | 106 | - | - | - | - | - |
| | | 1962 | 147 | 4,123 | 67 | 86 | 68 | 79 | 74 | 88 | 94 | 102 | 72 | 105 | 61 | 84 | 84 | .094 |
| | | 1963 | 154 | 4,592 | 74 | 71 | 72 | 97 | 77 | 99 | 110 | 109 | 117 | 111 | 95 | 73 | 92 | .103 |
| | | 1964 | 165 | 4,963 | 61 | 105 | 63 | 79 | 111 | 88 | 81 | 103 | 96 | 103 | 109 | 91 | 91 | .102 |
| | | 1965 | 174 | 5,412 | 88 | 80 | 71 | 95 | 90 | 105 | 110 | 117 | 121 | 100 | 73 | 94 | 94 | .108 |
| Pacifica | North Coast CWD | 1961 | 117 | 21,865 | 56 | 73 | 65 | 70 | 72 | 94 | 113 | 110 | 106 | 98 | 91 | 66 | 85 | .095 |
| | | 1962 | 126 | 24,138 | 67 | 71 | 66 | 71 | 66 | 107 | 133 | 102 | 110 | 99 | 87 | 76 | 90 | .101 |
| | | 1963 | 124 | 25,405 | 76 | 78 | 67 | 72 | 75 | 109 | 148 | 135 | 111 | 77 | 81 | 66 | 73 | .102 |
| | | 1964 | 104 | 27,335 | 60 | 68 | 70 | 71 | 73 | 106 | 98 | 112 | 117 | 121 | 90 | 67 | 80 | .101 |
| | | 1965 | 137 | 31,982 | 70 | 74 | 71 | 81 | 74 | 121 | 134 | 129 | 127 | 109 | 102 | 84 | 99 | .110 |
| Redwood City | -MWD | 1961 | 2,141 | 46,200 | 80 | 91 | 80 | 107 | 114 | 162 | 170 | 167 | 177 | 136 | 131 | 93 | 127 | .142 |
| | | 1962 | 2,221 | 48,000 | 81 | 101 | 82 | 102 | 146 | 157 | 172 | 171 | 171 | 117 | 100 | 81 | 127 | .142 |
| | | 1963 | 2,158 | 50,000 | 73 | 91 | 88 | 91 | 91 | 141 | 162 | 146 | 168 | 131 | 101 | 85 | 118 | .132 |
| | | 1964 | 2,822 | 52,100 | 85 | 95 | 98 | 130 | 142 | 176 | 171 | 169 | 152 | 127 | 91 | 88 | 127 | .142 |
| | | 1965 | 2,566 | 54,450 | 80 | 90 | 94 | 91 | 147 | 154 | 161 | 159 | 142 | 128 | 92 | 81 | 112 | .133 |
| San Bruno | -MWD | 1961 | 1,590 | 29,830 | - | - | - | - | - | - | - | - | - | - | - | - | 146 | .162 |
| | | 1962 | 1,547 | 30,810 | - | - | - | - | - | - | - | - | - | - | - | - | 140 | .173 |
| | | 1963 | 1,462 | 33,380 | - | - | - | - | - | - | - | - | - | - | - | - | 118 | .132 |
| | | 1964 | 1,531 | 34,575 | 85 | 86 | 93 | 107 | 117 | 135 | 140 | 156 | 149 | 137 | 125 | 102 | 119 | .131 |
| | | 1965 | 1,497 | 35,200 | 86 | 99 | 94 | 104 | 104 | 136 | 138 | 135 | 141 | 136 | 116 | 85 | 116 | .130 |
| San Mateo Serrano Co. (MWD) | Cal. Water Serrano Co. (MWD) | 1960 | 1,410 | 70,940 | 89 | 90 | 88 | 126 | 130 | 188 | 195 | 172 | 157 | 141 | 111 | 80 | 132 | .148 |
| | | 1962 | 1,444 | 71,687 | 78 | 93 | 95 | 144 | 165 | 188 | 187 | 183 | 160 | 113 | 107 | 95 | 135 | .151 |
| | | 1963 | 1,417 | 72,064 | 100 | 96 | 102 | 94 | 131 | 183 | 191 | 183 | 164 | 118 | 96 | 97 | 130 | .146 |
| | | 1964 | 1,816 | 72,000 | 94 | 112 | 112 | 147 | 160 | 176 | 196 | 193 | 173 | 147 | 106 | 97 | 144 | .161 |
| | | 1965 | 1,824 | 72,000 | 94 | 97 | 102 | 113 | 113 | 186 | 204 | 192 | 190 | 161 | 137 | 94 | 144 | .161 |
| SONOMA Sonoma | -MWD | 1964 | - | 3,532 | - | - | - | - | - | - | 267 | 262 | 231 | 170 | 105 | 98 | - | - |
| | | 1965 | 222 | 3,652 | 92 | 108 | 100 | 109 | 227 | 244 | 238 | 256 | 208 | 173 | 143 | 95 | 166 | .186 |
| | | 1966 | 271 | 3,901 | 86 | 90 | 108 | 170 | 251 | 280 | 276 | 300 | 240 | 206 | 164 | 102 | 141 | .211 |
| | | 1967 | - | 4,024 | 113 | 109 | 109 | 94 | 200 | 203 | - | - | - | - | - | - | - | - |
| West Bay With ENTIRE SYSTEM | -East Bay MWD | 1961 | 58,283 | 998,000 | 129 | 124 | 127 | 151 | 168 | 202 | 211 | 200 | 187 | 166 | 141 | 114 | 159 | .173 |
| | | 1962 | 58,222 | 1,016,000 | 124 | 121 | 124 | 158 | 178 | 198 | 198 | 204 | 185 | 147 | 132 | 119 | 177 | .176 |
| | | 1963 | 57,744 | 1,034,000 | 124 | 120 | 128 | 121 | 150 | 190 | 207 | 202 | 182 | 111 | 120 | 124 | 171 | .171 |
| | | 1964 | 64,128 | 1,052,000 | 121 | 136 | 137 | 168 | 176 | 181 | 211 | 221 | 210 | 181 | 130 | 122 | 167 | .189 |
| | | 1965 | 66,184 | 1,070,000 | 126 | 131 | 137 | 144 | 177 | 201 | 210 | 222 | 204 | 186 | 144 | 131 | 171 | .193 |

* Refer to last page of Appendix C for abbreviations.

TABLE 12c
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

| County City | Agency * (Name and Type) | Year of Record | Annual Water Into System (million gals.) | Estimated Average Population Served | Average Daily Water Use | | | | | | | | | | | | Total | |
|--------------------------------|--|----------------------|---|--|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------|------|
| | | | | | Monthly (gpcd) | | | | | | | | | | | | Annually | |
| | | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | gpcd | afcy |
| MONTEREY Carmel | Cal. American Water Co. (CWC) | 1999 | 368 | 6,904 | 105 | - | 111 | - | 156 | - | 190 | - | 185 | - | 130 | - | 146 | .164 |
| | | 1960 | 353 | 6,920 | 98 | - | 106 | - | 148 | - | 180 | - | 176 | - | 123 | - | 139 | .156 |
| | | 1961 | 385 | 6,981 | 108 | - | 115 | - | 161 | - | 195 | - | 190 | - | 134 | - | 151 | .169 |
| | | 1962 | 55 | 7,094 | 104 | - | 110 | - | 154 | - | 187 | - | 182 | - | 128 | - | 144 | .161 |
| | | 1963 | 340 | 7,116 | 94 | - | 100 | - | 139 | - | 170 | - | 165 | - | 116 | - | 131 | .147 |
| King City | Cal. Water Service Co. (CWC) | 1962 | 280 | 2,958 | 130 | 149 | 147 | 295 | 337 | 390 | 370 | 383 | 335 | 236 | 209 | 146 | 261 | .292 |
| | | 1963 | 256 | 2,989 | 134 | 130 | 154 | 146 | 274 | 348 | 380 | 379 | 327 | 252 | 160 | 164 | 237 | .265 |
| | | 1964 | 289 | 3,018 | 119 | 177 | 203 | 262 | 284 | 348 | 391 | 421 | 365 | 276 | 136 | 152 | 261 | .292 |
| | | 1965 | 257 | 3,046 | 111 | 105 | 119 | 147 | 188 | 270 | 301 | 333 | 418 | 349 | 278 | 151 | 231 | .259 |
| Monterey | Cal. American Water Co. (CWC) | 1999 | 863 | 20,917 | 86 | - | 81 | - | 111 | - | 141 | - | 149 | - | 111 | - | 113 | .127 |
| | | 1960 | 865 | 21,540 | 83 | - | 80 | - | 110 | - | 139 | - | 148 | - | 109 | - | 110 | .123 |
| | | 1961 | 927 | 21,869 | 88 | - | 86 | - | 114 | - | 144 | - | 153 | - | 113 | - | 116 | .130 |
| | | 1962 | 948 | 22,195 | 88 | - | 84 | - | 114 | - | 145 | - | 153 | - | 114 | - | 117 | .131 |
| | | 1963 | 900 | 22,603 | 83 | - | 79 | - | 107 | - | 136 | - | 144 | - | 107 | - | 109 | .122 |
| Monterey Bay Cities | Cal. American Water Service Co. (CWC) | 1961 | 3,581 | 86,100 | 83 | 66 | 75 | 117 | 126 | 158 | 159 | 143 | 145 | 129 | 97 | 72 | 114 | .128 |
| | | 1962 | 3,553 | 87,700 | 96 | 72 | 79 | 119 | 142 | 146 | 138 | 151 | 122 | 104 | 92 | 73 | 111 | .124 |
| | | 1963 | 3,335 | 89,600 | 82 | 68 | 75 | 74 | 107 | 143 | 156 | 143 | 127 | 98 | 79 | 67 | 102 | .114 |
| | | 1964 | 3,615 | 91,700 | 78 | 91 | 95 | 115 | 120 | 142 | 146 | 141 | 128 | 108 | 67 | 67 | 108 | .121 |
| | | 1965 | 3,740 | 92,300 | 69 | 86 | 83 | 86 | 137 | 150 | 156 | 146 | 143 | 127 | 78 | 70 | 111 | .124 |
| Pacific Grove | Cal. American Water Co. (CWC) | 1999 | 425 | 11,883 | 72 | - | 68 | - | 96 | - | 131 | - | 129 | - | 93 | - | 98 | .110 |
| | | 1960 | 462 | 12,042 | 75 | - | 72 | - | 103 | - | 140 | - | 138 | - | 99 | - | 105 | .118 |
| | | 1961 | 474 | 12,250 | 76 | - | 73 | - | 104 | - | 141 | - | 139 | - | 100 | - | 106 | .119 |
| | | 1962 | 441 | 12,458 | 74 | - | 70 | - | 95 | - | 129 | - | 127 | - | 92 | - | 97 | .109 |
| | | 1963 | 467 | 12,659 | 71 | - | 66 | - | 100 | - | 135 | - | 133 | - | 96 | - | 101 | .114 |
| Salinas | Cal. Water Service Co. (CWC) | 1961 | 1,732 | 33,841 | 91 | 96 | 90 | 107 | 142 | 169 | 190 | 191 | 187 | 164 | 151 | 104 | 140 | .157 |
| | | 1962 | 1,578 | 34,320 | 92 | 91 | 74 | 85 | 145 | 181 | 181 | 167 | 186 | 138 | 134 | 105 | 138 | .155 |
| | | 1963 | 2,000 | 34,800 | 116 | 101 | 113 | 115 | 157 | 218 | 234 | 223 | 213 | 162 | 116 | 118 | 157 | .176 |
| | | 1964 | 2,098 | 35,900 | 107 | 121 | 122 | 156 | 176 | 214 | 228 | 212 | 193 | 170 | 111 | 104 | 160 | .179 |
| | | 1965 | 2,190 | 38,800 | 96 | 104 | 104 | 117 | 159 | 193 | 194 | 202 | 212 | 190 | 171 | 112 | 155 | .174 |
| Seaside | Cal. American Water Co. (CWC) | 1959 | 327 | 10,190 | 62 | - | 73 | - | 100 | - | 117 | - | 102 | - | 75 | - | 88 | .099 |
| | | 1960 | 346 | 10,639 | 62 | - | 73 | - | 101 | - | 118 | - | 103 | - | 76 | - | 89 | .100 |
| | | 1961 | 360 | 10,966 | 64 | - | 74 | - | 102 | - | 118 | - | 104 | - | 76 | - | 90 | .101 |
| | | 1962 | 354 | 11,149 | 62 | - | 71 | - | 98 | - | 114 | - | 100 | - | 74 | - | 87 | .097 |
| | | 1963 | 355 | 11,331 | 61 | - | 71 | - | 97 | - | 114 | - | 99 | - | 73 | - | 86 | .096 |
| SAN BENITO Hollister | -HMD | 1960-61 | 341 | 6,071 | - | - | - | - | - | - | - | - | - | - | - | - | 154 | .173 |
| | | 1961-62 | 356 | 6,295 | - | - | - | - | - | - | - | - | - | - | - | - | 155 | .174 |
| | | 1962-63 | 329 | 6,525 | - | - | - | - | - | - | - | - | - | - | - | - | 138 | .155 |
| | | 1964 | 354 | 7,058 | 86 | 95 | 99 | 126 | 139 | 161 | 188 | 185 | 203 | 169 | 95 | 98 | 137 | .153 |
| | | 1965 | 418 | 7,306 | 111 | 99 | 113 | 121 | 156 | 184 | 199 | 208 | 261 | 237 | 101 | 89 | 157 | .176 |
| SAN LUIS OBISPO Paso Robles | -HMD | 1961 | 683 | 6,677 | 146 | 148 | 166 | 292 | 310 | 427 | 524 | 444 | 361 | 271 | 173 | 124 | 280 | .314 |
| | | 1962 | 667 | 6,689 | 116 | 142 | 125 | 276 | 338 | 418 | 454 | 453 | 362 | 235 | 198 | 154 | 273 | .306 |
| | | 1963 | 605 | 6,677 | 162 | 146 | 150 | 134 | 240 | 380 | 439 | 446 | 358 | 231 | 152 | 137 | 248 | .278 |
| | | 1964 | 740 | 7,000 | 117 | 165 | 196 | 244 | 323 | 417 | 482 | 462 | 455 | 309 | 144 | 146 | 289 | .324 |
| | | 1965 | 698 | 7,000 | 112 | 149 | 165 | 204 | 369 | 382 | 484 | 458 | 343 | 295 | 175 | 135 | 273 | .306 |
| San Luis Obispo | -HMD | 1961 | 1,394 | 21,500 | 132 | 122 | 133 | 182 | 196 | 228 | 240 | 226 | 204 | 195 | 162 | 115 | 178 | .192 |
| | | 1962 | 1,398 | 22,350 | 100 | 111 | 114 | 184 | 210 | 220 | 222 | 234 | 205 | 164 | 156 | 129 | 171 | .192 |
| | | 1963 | 1,335 | 24,100 | 131 | 112 | 120 | 113 | 150 | 194 | 214 | 211 | 186 | 146 | 118 | 125 | 152 | .170 |
| | | 1964 | 1,501 | 25,300 | 125 | 149 | 130 | 152 | 168 | 200 | 220 | 205 | 189 | 171 | 120 | 118 | 162 | .181 |
| | | 1965 | 1,527 | 25,750 | 112 | 130 | 122 | 131 | 189 | 168 | 213 | 214 | 192 | 197 | 139 | 109 | 160 | .184 |

* Refer to last page of Appendix O for abbreviations.

TABLE 12c
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

| County City | Agency (Name and Type)* | Year of Record | Annual Water Into System (Million Gals) | Estimated Average Population Served | Average Daily Water Use | | | | | | | | | | | | Total | |
|----------------|----------------------------|----------------------|--|--|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------|------|
| | | | | | Monthly (gpcd) | | | | | | | | | | | | Annually | |
| | | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | gpcd | afpy |
| SANTA BARBARA | | | | | | | | | | | | | | | | | | |
| Santa Barbara | -MWD | 1961 | 3,872 | 99,083 | 154 | 174 | 179 | 205 | 222 | 218 | 245 | 239 | 211 | 184 | 142 | 80 | 188 | .211 |
| | | 1962 | 3,888 | 62,463 | 120 | 112 | 115 | 170 | 211 | 202 | 215 | 232 | 212 | 163 | 153 | 142 | 171 | .192 |
| | | 1963 | 3,763 | 64,500 | 152 | 82 | 147 | 122 | 155 | 161 | 230 | 338 | 188 | 145 | 114 | 144 | 156 | .175 |
| | | 1964 | 4,186 | 66,400 | 139 | 142 | 142 | 189 | 190 | 194 | 220 | 219 | 200 | 163 | 115 | 147 | 172 | .193 |
| | | 1965 | 3,939 | 69,857 | 117 | 140 | 149 | 120 | 153 | 178 | 202 | 206 | 180 | 146 | 113 | 99 | 154 | .173 |
| SANTA CLARA | | | | | | | | | | | | | | | | | | |
| Gilroy | -MWD | 1960-61 | 426 | 7,348 | - | - | - | - | - | - | - | - | - | - | - | - | 159 | .178 |
| | | 1961-62 | 447 | 7,800 | - | - | - | - | - | - | - | - | - | - | - | - | 157 | .176 |
| | | 1963 | 645 | 8,110 | 94 | 90 | 130 | 86 | 169 | 261 | 294 | 275 | 232 | 139 | 95 | 91 | 163 | .183 |
| | | 1964 | 611 | 9,314 | 89 | 110 | 142 | 182 | 212 | 256 | 309 | 263 | 232 | 199 | 99 | 48 | 183 | .205 |
| | | 1965 | 523 | 9,666 | 97 | 100 | 166 | 131 | 245 | 276 | 299 | 242 | 187 | 169 | 99 | 77 | 174 | .192 |
| SANTA CRUZ | | | | | | | | | | | | | | | | | | |
| Santa Cruz | -MWD | 1961 | 2,292 | 37,024 | 93 | 102 | 128 | 147 | 147 | 218 | 246 | 237 | 242 | 211 | 145 | 116 | 169 | .189 |
| | | 1962 | 2,128 | 38,448 | 115 | 96 | 96 | 161 | 130 | 177 | 175 | 220 | 207 | 186 | 148 | 107 | 152 | .170 |
| | | 1963 | 2,000 | 38,402 | 115 | 97 | 105 | 114 | 125 | 173 | 140 | 201 | 203 | 157 | 123 | 108 | 142 | .159 |
| | | 1964 | 2,446 | 39,420 | 128 | 117 | 115 | 165 | 156 | 186 | 220 | 259 | 236 | 210 | 125 | 116 | 169 | .189 |
| | | 1965 | 2,277 | 39,963 | 111 | 101 | 112 | 132 | 160 | 166 | 215 | 221 | 198 | 182 | 144 | 130 | 156 | .175 |

* Refer to last page of Appendix C for abbreviations.

TABLE 12d
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

| County City | Agency (Name and Type)* | Year of Record | Annual Water Into System (million gals.) | Estimated Average Population Served | Average Daily Water Use | | | | | | | | | | | | Total | |
|-------------------------------|-------------------------|----------------|--|-------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------|------|
| | | | | | Monthly (gpcd) | | | | | | | | | | | | Annually | |
| | | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | gpcd | afpy |
| LOS ANGELES | | | | | | | | | | | | | | | | | | |
| Beverly Hills | -MWD | 1961 | 3,905 | 38,540 | 215 | 274 | 258 | 294 | 286 | 336 | 345 | 324 | 305 | 292 | 246 | 192 | 278 | .209 |
| | | 1962 | 4,008 | 39,150 | 211 | 188 | 196 | 278 | 299 | 282 | 372 | 408 | 291 | 323 | 274 | 234 | 279 | .312 |
| | | 1963 | 4,566 | 39,820 | 328 | 398 | 274 | 301 | 352 | 443 | 340 | 330 | 303 | 264 | 203 | 254 | 313 | .352 |
| | | 1964 | 4,078 | 40,505 | 231 | 274 | 249 | 259 | 290 | 288 | 347 | 330 | 310 | 274 | 225 | 230 | 274 | .307 |
| | | 1965 | 3,999 | 41,330 | 200 | 222 | 243 | 231 | 288 | 282 | 319 | 343 | 289 | 311 | 227 | 222 | 264 | .296 |
| Burbank | -MWD | 1961 | 8,236 | 90,900 | 196 | 203 | 215 | 243 | 262 | 301 | 331 | 319 | 275 | 254 | 208 | 168 | 248 | .278 |
| | | 1962 | 8,197 | 91,800 | 184 | 165 | 177 | 260 | 260 | 274 | 311 | 336 | 288 | 239 | 227 | 208 | 244 | .273 |
| | | 1963 | 8,114 | 92,900 | 204 | 195 | 198 | 200 | 243 | 251 | 332 | 322 | 286 | 239 | 192 | 203 | 239 | .268 |
| | | 1964 | 8,337 | 94,400 | 190 | 216 | 208 | 222 | 254 | 262 | 335 | 311 | 275 | 256 | 183 | 180 | 242 | .273 |
| | | 1965 | 8,043 | 96,034 | 174 | 196 | 203 | 201 | 257 | 246 | 306 | 320 | 233 | 265 | 187 | 165 | 229 | .257 |
| Glendale | -MWD | 1961 | 7,815 | 120,500 | 143 | 134 | 144 | 184 | 197 | 221 | 250 | 234 | 195 | 187 | 145 | 97 | 177 | .198 |
| | | 1962 | 7,226 | 122,500 | 116 | 100 | 98 | 172 | 180 | 186 | 220 | 236 | 196 | 154 | 148 | 138 | 162 | .181 |
| | | 1963 | 6,912 | 125,500 | 131 | 112 | 126 | 117 | 155 | 155 | 230 | 218 | 186 | 146 | 109 | 121 | 150 | .168 |
| | | 1964 | 7,585 | 128,600 | 124 | 139 | 133 | 135 | 172 | 181 | 237 | 220 | 194 | 175 | 115 | 110 | 161 | .180 |
| | | 1965 | 7,170 | 131,754 | 103 | 112 | 132 | 119 | 174 | 163 | 213 | 214 | 151 | 180 | 122 | 99 | 149 | .167 |
| Long Beach | -MWD | 1961 | 17,579 | 349,000 | 118 | 119 | 120 | 139 | 154 | 162 | 175 | 170 | 152 | 142 | 117 | 88 | 138 | .155 |
| | | 1962 | 16,879 | 353,000 | 95 | 88 | 94 | 132 | 150 | 154 | 166 | 182 | 155 | 125 | 118 | 107 | 131 | .146 |
| | | 1963 | 16,940 | 357,000 | 116 | 99 | 109 | 110 | 136 | 152 | 176 | 176 | 148 | 129 | 102 | 110 | 130 | .146 |
| | | 1964 | 16,630 | 362,000 | 108 | 129 | 121 | 137 | 158 | 163 | 184 | 176 | 162 | 141 | 109 | 106 | 141 | .158 |
| | | 1965 | 18,108 | 367,500 | 105 | 115 | 113 | 112 | 150 | 154 | 171 | 177 | 149 | 159 | 112 | 100 | 135 | .151 |
| Los Angeles (City and Harbor) | -MWD | 1940 | 56,916 | 1,392,276 | 84 | 90 | 99 | 103 | 121 | 125 | 139 | 136 | 128 | 119 | 104 | 94 | 112 | .125 |
| | | 1941 | 56,092 | 1,436,231 | 86 | 83 | 83 | 88 | 124 | 130 | 134 | 130 | 126 | 111 | 104 | 88 | 107 | .120 |
| | | 1942 | 59,367 | 1,492,204 | 88 | 92 | 96 | 89 | 120 | 124 | 137 | 130 | 118 | 115 | 102 | 100 | 109 | .122 |
| | | 1943 | 65,532 | 1,574,900 | 91 | 90 | 88 | 104 | 127 | 134 | 141 | 141 | 134 | 120 | 114 | 98 | 114 | .128 |
| | | 1944 | 71,044 | 1,635,640 | 99 | 98 | 105 | 121 | 127 | 134 | 137 | 146 | 134 | 126 | 104 | 109 | 119 | .134 |
| | | 1945 | 75,293 | 1,595,279 | 112 | 110 | 108 | 128 | 143 | 143 | 152 | 157 | 149 | 135 | 123 | 114 | 131 | .147 |
| | | 1946 | 79,157 | 1,630,584 | 114 | 118 | 122 | 123 | 135 | 160 | 163 | 163 | 153 | 129 | 115 | 109 | 133 | .149 |
| | | 1947 | 82,458 | 1,685,913 | 112 | 115 | 118 | 138 | 140 | 149 | 166 | 159 | 146 | 131 | 126 | 112 | 134 | .150 |
| | | 1948 | 83,304 | 1,716,008 | 117 | 120 | 112 | 120 | 142 | 146 | 160 | 157 | 151 | 134 | 130 | 112 | 133 | .149 |
| | | 1949 | 82,012 | 1,755,390 | 104 | 105 | 107 | 133 | 135 | 155 | 155 | 158 | 149 | 135 | 119 | 102 | 128 | .143 |
| | | 1950 | 82,548 | 1,638,829 | 107 | 110 | 126 | 134 | 148 | 160 | 167 | 163 | 143 | 146 | 123 | 122 | 138 | .154 |
| | | 1951 | 85,834 | 1,633,075 | 117 | 118 | 134 | 134 | 152 | 164 | 177 | 171 | 160 | 158 | 133 | 113 | 144 | .161 |
| | | 1952 | 89,494 | 1,667,956 | 112 | 133 | 120 | 128 | 162 | 168 | 182 | 183 | 177 | 155 | 128 | 118 | 147 | .165 |
| | | 1953 | 90,330 | 1,683,739 | 121 | 145 | 149 | 150 | 175 | 183 | 201 | 183 | 173 | 168 | 136 | 142 | 160 | .179 |
| | | 1954 | 93,934 | 1,649,700 | 126 | 136 | 133 | 140 | 164 | 182 | 203 | 188 | 180 | 158 | 140 | 132 | 156 | .175 |
| | | 1955 | 94,077 | 1,662,867 | 123 | 133 | 145 | 160 | 146 | 176 | 187 | 198 | 190 | 153 | 138 | 122 | 155 | .174 |
| | | 1956 | 99,081 | 1,675,648 | 124 | 132 | 151 | 136 | 156 | 185 | 194 | 189 | 187 | 158 | 167 | 148 | 162 | .181 |
| | | 1957 | 95,749 | 1,688,316 | 126 | 129 | 138 | 149 | 162 | 189 | 200 | 200 | 179 | 147 | 138 | 130 | 157 | .178 |
| | | 1958 | 99,733 | 1,729,376 | 133 | 121 | 123 | 142 | 170 | 189 | 188 | 184 | 181 | 173 | 150 | 146 | 158 | .177 |
| | | 1959 | 105,558 | 1,731,730 | 135 | 130 | 154 | 164 | 171 | 190 | 210 | 197 | 181 | 167 | 161 | 142 | 167 | .187 |
| | | 1960 | 101,660 | 1,762,795 | 128 | 134 | 144 | 161 | 168 | 174 | 199 | 188 | 184 | 164 | 126 | 131 | 158 | .177 |
| | | 1961 | 104,117 | 1,760,620 | 142 | 146 | 150 | 164 | 175 | 185 | 194 | 190 | 151 | 169 | 147 | 125 | 162 | .181 |
| | | 1962 | 100,010 | 1,779,229 | 132 | 123 | 126 | 152 | 171 | 169 | 181 | 188 | 170 | 155 | 145 | 140 | 154 | .173 |
| | | 1963 | 100,691 | 1,803,088 | 143 | 128 | 134 | 136 | 156 | 162 | 187 | 188 | 171 | 156 | 130 | 140 | 151 | .171 |
| | | 1964 | 105,862 | 1,824,111 | 137 | 149 | 143 | 152 | 170 | 170 | 195 | 186 | 175 | 162 | 133 | 130 | 159 | .178 |
| | | 1965 | 102,213 | 1,842,330 | 127 | 138 | 137 | 127 | 165 | 165 | 179 | 184 | 162 | 178 | 141 | 127 | 152 | .170 |

* Refer to last page of Appendix C for abbreviations.

TABLE 12d
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

| County City | Agency* (Name and Type) | Year of Record | Annual Water Use System | Estimated Average Population Served | Average Daily Water Use Monthly (gpcd) | | | | | | | | | | | | Annually | |
|--------------------------------------|----------------------------|----------------------|----------------------------------|--|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------|------|
| | | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | gpcd | afpy |
| | | | | | | | | | | | | | | | | | | |
| Los Angeles (San Fernando Valley) | -MWD | 1940 | 7,340 | 112,001 | 78 | 81 | 109 | 167 | 254 | 271 | 316 | 220 | 237 | 197 | 152 | 104 | 182 | .204 |
| | | 1941 | 7,811 | 122,200 | 67 | 92 | 102 | 145 | 249 | 276 | 313 | 212 | 227 | 181 | 160 | 77 | 175 | .196 |
| | | 1942 | 9,506 | 138,530 | 85 | 94 | 146 | 118 | 261 | 252 | 402 | 235 | 249 | 157 | 150 | 93 | 188 | .210 |
| | | 1943 | 10,704 | 151,170 | 75 | 62 | 73 | 170 | 257 | 302 | 348 | 313 | 243 | 203 | 186 | 89 | 194 | .217 |
| | | 1944 | 11,649 | 159,500 | 99 | 80 | 143 | 203 | 242 | 258 | 307 | 364 | 260 | 200 | 117 | 125 | 200 | .224 |
| | | 1945 | 13,420 | 159,160 | 118 | 105 | 118 | 216 | 323 | 300 | 416 | 351 | 328 | 186 | 178 | 136 | 231 | .259 |
| | | 1946 | 14,364 | 175,686 | 135 | 134 | 155 | 178 | 261 | 342 | 403 | 344 | 334 | 180 | 114 | 110 | 224 | .251 |
| | | 1947 | 17,097 | 219,911 | 99 | 127 | 140 | 228 | 249 | 268 | 399 | 304 | 232 | 189 | 156 | 105 | 213 | .239 |
| | | 1948 | 19,033 | 245,266 | 156 | 108 | 130 | 168 | 268 | 260 | 368 | 310 | 308 | 177 | 193 | 102 | 212 | .238 |
| | | 1949 | 21,173 | 295,958 | 72 | 70 | 101 | 214 | 255 | 272 | 320 | 329 | 270 | 199 | 149 | 96 | 196 | .219 |
| | | 1950 | 21,589 | 330,435 | 82 | 101 | 148 | 169 | 235 | 261 | 323 | 296 | 186 | 191 | 126 | 129 | 179 | .201 |
| | | 1951 | 26,400 | 341,175 | 84 | 107 | 184 | 168 | 282 | 266 | 385 | 318 | 306 | 218 | 139 | 81 | 212 | .237 |
| | | 1952 | 25,284 | 353,428 | 82 | 126 | 90 | 95 | 255 | 272 | 369 | 338 | 298 | 210 | 121 | 102 | 196 | .220 |
| | | 1953 | 33,575 | 381,632 | 104 | 176 | 208 | 185 | 282 | 311 | 410 | 337 | 300 | 250 | 151 | 170 | 241 | .270 |
| | | 1954 | 33,194 | 483,740 | 94 | 133 | 112 | 147 | 226 | 267 | 345 | 276 | 246 | 188 | 131 | 104 | 188 | .211 |
| | | 1955 | 35,344 | 506,261 | 66 | 94 | 134 | 186 | 160 | 255 | 289 | 318 | 271 | 193 | 132 | 105 | 184 | .206 |
| | | 1956 | 43,499 | 584,132 | 102 | 123 | 187 | 140 | 187 | 275 | 306 | 278 | 284 | 179 | 207 | 175 | 204 | .228 |
| | | 1957 | 43,148 | 635,552 | 84 | 100 | 123 | 164 | 183 | 288 | 322 | 296 | 250 | 147 | 138 | 122 | 166 | .208 |
| | | 1958 | 49,685 | 667,274 | 131 | 105 | 106 | 166 | 248 | 299 | 305 | 278 | 267 | 214 | 163 | 160 | 204 | .228 |
| | | 1959 | 54,962 | 684,455 | 130 | 114 | 192 | 219 | 240 | 295 | 340 | 302 | 237 | 217 | 206 | 160 | 220 | .247 |
| | | 1960 | 57,327 | 688,865 | 117 | 132 | 170 | 239 | 272 | 307 | 357 | 321 | 303 | 234 | 131 | 152 | 228 | .256 |
| Pasadena | -MWD | 1961 | 60,957 | 776,106 | 151 | 156 | 168 | 217 | 237 | 292 | 316 | 293 | 246 | 217 | 194 | 115 | 214 | .240 |
| | | 1962 | 59,127 | 802,778 | 133 | 112 | 121 | 216 | 216 | 232 | 292 | 306 | 248 | 188 | 172 | 160 | 202 | .225 |
| | | 1963 | 57,414 | 834,937 | 156 | 123 | 135 | 141 | 191 | 216 | 238 | 282 | 248 | 178 | 132 | 156 | 188 | .211 |
| | | 1964 | 63,840 | 866,768 | 142 | 170 | 156 | 173 | 220 | 238 | 311 | 266 | 239 | 212 | 136 | 132 | 201 | .225 |
| | | 1965 | 61,031 | 896,036 | 122 | 147 | 139 | 146 | 224 | 215 | 294 | 276 | 200 | 232 | 134 | 111 | 187 | .209 |
| | | 1961 | 1,133 | 117,500 | 202 | 195 | 210 | 261 | 281 | 324 | 370 | 364 | 311 | 275 | 215 | 150 | 263 | .295 |
| | | 1962 | 1,076 | 118,800 | 170 | 142 | 141 | 249 | 259 | 285 | 350 | 373 | 321 | 232 | 237 | 205 | 248 | .278 |
| Pomona | -MWD | 1963 | 1,042 | 120,200 | 203 | 175 | 106 | 178 | 242 | 240 | 354 | 354 | 393 | 336 | 177 | 195 | 245 | .274 |
| | | 1964 | 1,132 | 121,800 | 196 | 218 | 201 | 218 | 268 | 284 | 373 | 358 | 312 | 282 | 176 | 168 | 234 | .285 |
| | | 1965 | 1,051 | 122,585 | 163 | 191 | 192 | 193 | 267 | 247 | 337 | 346 | 243 | 232 | 192 | 151 | 235 | .263 |
| | | 1961 | - | 70,878 | - | - | - | - | - | - | 283 | 284 | 294 | 231 | 173 | 124 | - | - |
| | | 1962 | 5,270 | 72,196 | 140 | 122 | 116 | 205 | 206 | 239 | 279 | 294 | 249 | 229 | 161 | 154 | 200 | .224 |
| Santa Monica | -MWD | 1963 | 4,819 | 80,802 | 140 | 129 | 135 | 133 | 179 | 189 | 244 | 235 | 191 | 150 | 118 | 116 | 163 | .183 |
| | | 1964 | 5,439 | 81,409 | 118 | 142 | 127 | 141 | 181 | 213 | 285 | 252 | 235 | 224 | 135 | 138 | 183 | .205 |
| | | 1965 | 6,089 | 82,961 | 138 | 156 | 157 | 170 | 231 | 230 | 283 | 289 | 273 | 232 | 153 | 121 | 201 | .227 |
| | | 1961 | 4,670 | 84,300 | 140 | 133 | 138 | 151 | 157 | 170 | 181 | 174 | 166 | 159 | 139 | 113 | 152 | .170 |
| | | 1962 | 4,609 | 85,200 | 128 | 118 | 118 | 148 | 160 | 162 | 174 | 181 | 167 | 146 | 145 | 134 | 148 | .166 |
| Orange | -MWD | 1963 | 4,709 | 86,000 | 150 | 122 | 136 | 136 | 153 | 158 | 181 | 174 | 164 | 150 | 125 | 137 | 142 | .167 |
| | | 1964 | 4,888 | 87,200 | 135 | 152 | 141 | 143 | 162 | 156 | 168 | 174 | 174 | 159 | 133 | 133 | 153 | .171 |
| | | 1965 | 4,904 | 88,000 | 128 | 138 | 143 | 134 | 165 | 164 | 172 | 179 | 166 | 178 | 139 | 126 | 153 | .167 |
| | | 1961 | 707 | 114,100 | 122 | 127 | 132 | 172 | 185 | 231 | 226 | 225 | 198 | 172 | 140 | 99 | 169 | .189 |
| Anaheim | -MWD | 1962 | 759 | 123,800 | 104 | 94 | 100 | 155 | 175 | 243 | 229 | 248 | 207 | 168 | 148 | 136 | 167 | .187 |
| | | 1963 | 862 | 133,700 | 141 | 122 | 124 | 140 | 181 | 195 | 240 | 234 | 239 | 199 | 139 | 160 | 176 | .197 |
| | | 1964 | 1,130 | 148,200 | 137 | 196 | 162 | 191 | 231 | 258 | 300 | 280 | 243 | 215 | 124 | 145 | 209 | .234 |
| | | 1965 | 1,104 | 166,000 | 125 | 149 | 148 | 137 | 208 | 218 | 243 | 269 | 215 | 221 | 139 | 115 | 182 | .204 |

* Refer to last page of Appendix C for abbreviations.

TABLE 12d
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIZENS

| County City | Agency (Name and Type) * | Year of Record | Annual Water Into System (million gals.) | Estimated Average Population Served | Average Daily Water Use | | | | | | | | | | | | Total | |
|-------------------------|----------------------------------|-------------------|---|--|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|------|
| | | | | | Monthly (agpd) | | | | | | | | | | | | agpd | afpy |
| | | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| ORANGE | | | | | | | | | | | | | | | | | | |
| Fullerton | -MWD | 1961 | 5,494 | 58,740 | 198 | 204 | 212 | 280 | 288 | 310 | 324 | 337 | 288 | 271 | 209 | 139 | 255 | .286 |
| | | 1962 | 5,373 | 59,300 | 157 | 140 | 150 | 254 | 264 | 289 | 328 | 381 | 315 | 275 | 216 | 206 | 243 | .278 |
| | | 1963 | 5,640 | 64,100 | 215 | 163 | 188 | 196 | 259 | 281 | 345 | 344 | 283 | 247 | 180 | 197 | 242 | .273 |
| | | 1964 | 6,837 | 70,400 | 185 | 222 | 206 | 240 | 280 | 287 | 378 | 376 | 346 | 303 | 186 | 176 | 265 | .297 |
| | | 1965 | 6,485 | 78,030 | 142 | 179 | 192 | 175 | 254 | 265 | 306 | 335 | 272 | 243 | 179 | 135 | 227 | .294 |
| | | | | | | | | | | | | | | | | | | |
| Santa Ana | -MWD | 1961 | 5,846 | 102,510 | 111 | 123 | 121 | 164 | 181 | 189 | 203 | 201 | 175 | 160 | 135 | 95 | 155 | .174 |
| | | 1962 | 5,841 | 108,630 | 102 | 91 | 96 | 146 | 163 | 176 | 198 | 206 | 179 | 151 | 132 | 124 | 147 | .165 |
| | | 1963 | 6,233 | 113,850 | 131 | 111 | 126 | 129 | 170 | 179 | 207 | 206 | 164 | 139 | 107 | 121 | 149 | .167 |
| | | 1964 | 6,832 | 118,440 | 114 | 142 | 129 | 145 | 177 | 184 | 221 | 212 | 180 | 161 | 120 | 113 | 158 | .177 |
| | | 1965 | 6,881 | 122,040 | 109 | 128 | 125 | 126 | 179 | 186 | 208 | 214 | 170 | 180 | 120 | 102 | 154 | .173 |
| | | | | | | | | | | | | | | | | | | |
| RIVERSIDE | | | | | | | | | | | | | | | | | | |
| Riverside | -MWD | 1961 | 8,524 | 88,367 | 176 | 197 | 201 | 281 | 290 | 364 | 381 | 367 | 317 | 268 | 197 | 135 | 264 | .296 |
| | | 1962 | 8,467 | 94,817 | 146 | 115 | 129 | 258 | 262 | 315 | 367 | 384 | 314 | 240 | 198 | 187 | 243 | .272 |
| | | 1963 | 8,634 | 103,600 | 161 | 145 | 167 | 175 | 261 | 299 | 379 | 345 | 257 | 159 | 164 | 179 | 224 | .251 |
| | | 1964 | 9,572 | 126,600 | 137 | 168 | 149 | 177 | 228 | 267 | 338 | 292 | 243 | 218 | 139 | 124 | 207 | .232 |
| | | 1965 | 9,767 | 133,200 | 121 | 165 | 150 | 147 | 233 | 246 | 315 | 292 | 242 | 236 | 146 | 108 | 200 | .225 |
| | | | | | | | | | | | | | | | | | | |
| SAN BERNARDINO | | | | | | | | | | | | | | | | | | |
| San Bernardino | -MWD | 1961 | 7,566 | 92,126 | 148 | 163 | 152 | 220 | 246 | 337 | 353 | 312 | 268 | 227 | 157 | 110 | 224 | .251 |
| | | 1962 | 7,236 | 92,126 | 128 | 104 | 103 | 219 | 217 | 286 | 289 | 346 | 286 | 208 | 179 | 164 | 214 | .240 |
| | | 1963 | 6,975 | 96,300 | 135 | 134 | 148 | 141 | 225 | 244 | 349 | 321 | 234 | 172 | 129 | 142 | 198 | .222 |
| | | 1964 | 7,812 | 100,300 | 131 | 161 | 137 | 174 | 226 | 276 | 366 | 327 | 269 | 230 | 138 | 124 | 213 | .239 |
| | | 1965 | 7,649 | 100,300 | 124 | 156 | 149 | 164 | 232 | 242 | 336 | 343 | 241 | 251 | 150 | 113 | 208 | .233 |
| | | | | | | | | | | | | | | | | | | |
| SAN DIEGO | | | | | | | | | | | | | | | | | | |
| Carlsbad | -MWD | 1961 | 1,332 | 9,437 | 228 | 220 | 349 | 336 | 515 | 478 | 572 | 577 | 538 | 403 | 329 | 84 | 386 | .432 |
| | | 1962 | 1,138 | 10,150 | 164 | 104 | 95 | 280 | 383 | 402 | 430 | 467 | 437 | 367 | 223 | 262 | 306 | .343 |
| | | 1963 | 1,188 | 11,500 | 222 | 179 | 191 | 206 | 360 | 383 | 512 | 494 | 290 | 270 | 106 | 192 | 284 | .318 |
| | | 1964 | 1,219 | 11,988 | 164 | 205 | 233 | 246 | 342 | 332 | 397 | 414 | 379 | 292 | 161 | 173 | 278 | .311 |
| | | 1965 | 1,198 | 12,500 | 153 | 170 | 276 | 105 | 346 | 358 | 352 | 390 | 329 | 361 | 256 | 97 | 266 | .298 |
| | | | | | | | | | | | | | | | | | | |
| Chula Vista Area Cities | Cal. American Water Co. (C.W.C.) | 1961 | 1,717 | 101,844 | 73 | 83 | 75 | 83 | 95 | 118 | 116 | 125 | 127 | 114 | 104 | 82 | 100 | .112 |
| | | 1962 | 3,600 | 103,256 | 69 | 70 | 60 | 66 | 104 | 107 | 109 | 127 | 125 | 114 | 104 | 90 | 96 | .108 |
| | | 1963 | 3,750 | 106,540 | 79 | 87 | 79 | 82 | 94 | 106 | 107 | 128 | 122 | 104 | 92 | 77 | 96 | .108 |
| | | 1964 | 3,974 | 108,862 | 76 | 83 | 74 | 85 | 82 | 105 | 118 | 129 | 126 | 134 | 103 | 74 | 100 | .112 |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| Escondido | -MWD | 1961 | 1,148 | 18,438 | 105 | 100 | 110 | 161 | 183 | 224 | 246 | 246 | 210 | 180 | 135 | 84 | 246 | .185 |
| | | 1962 | 1,047 | 20,599 | 87 | 76 | 74 | 148 | 124 | 126 | 210 | 229 | 188 | 150 | 140 | 112 | 222 | .156 |
| | | 1963 | 1,231 | 22,760 | 101 | 106 | 104 | 122 | 158 | 183 | 242 | 232 | 183 | 141 | 101 | 101 | 242 | .166 |
| | | 1964 | 1,373 | 24,221 | 94 | 105 | 95 | 129 | 146 | 202 | 245 | 238 | 192 | 162 | 105 | 93 | 245 | .169 |
| | | 1965 | 1,382 | 27,179 | 77 | 87 | 101 | 103 | 160 | 174 | 215 | 219 | 168 | 172 | 113 | 78 | 219 | .156 |
| | | | | | | | | | | | | | | | | | | |
| Oceanside | -MWD | 1961 | 1,243 | 26,905 | 122 | 121 | 135 | 129 | 166 | 189 | 208 | 208 | 208 | 138 | 158 | 80 | 157 | .176 |
| | | 1962 | 1,342 | 28,800 | 84 | 77 | 73 | 102 | 140 | 171 | 179 | 208 | 206 | 142 | 129 | 119 | 136 | .152 |
| | | 1963 | 1,663 | 30,005 | 109 | 126 | 128 | 120 | 148 | 168 | 194 | 228 | 196 | 143 | 142 | 123 | 152 | .170 |
| | | 1964 | 1,742 | 31,250 | 106 | 126 | 113 | 144 | 167 | 185 | 190 | 185 | 192 | 180 | 131 | 108 | 153 | .171 |
| | | 1965 | 1,873 | 33,800 | 15 | 131 | 113 | 102 | 142 | 174 | 197 | 201 | 260 | 183 | 138 | 81 | 154 | .169 |
| | | | | | | | | | | | | | | | | | | |
| San Diego | -MWD | 1961 | 27,060 | 588,400 | 107 | 67 | 107 | 134 | 137 | 146 | 154 | 154 | 142 | 131 | 112 | 85 | 126 | .141 |
| | | 1962 | 27,003 | 616,500 | 76 | 81 | 85 | 118 | 124 | 131 | 158 | 161 | 146 | 128 | 110 | 100 | 120 | .143 |
| | | 1963 | 28,662 | 628,200 | 106 | 106 | 107 | 115 | 139 | 132 | 162 | 163 | 129 | 128 | 100 | 109 | 125 | .140 |
| | | 1964 | 29,849 | 638,400 | 99 | 112 | 106 | 121 | 148 | 146 | 167 | 154 | 148 | 137 | 103 | 101 | 128 | .143 |
| | | 1965 | 30,284 | 648,700 | 100 | 102 | 110 | 109 | 140 | 143 | 159 | 173 | 147 | 134 | 106 | 95 | 128 | .143 |
| | | | | | | | | | | | | | | | | | | |
| VENTURA | | | | | | | | | | | | | | | | | | |
| Oxnard | -MWD | 1961 | 2,891 | 40,265 | 139 | 113 | 131 | 129 | 106 | 180 | 172 | 210 | 248 | 181 | 157 | 101 | 170 | .190 |
| | | 1962 | 2,804 | 40,300 | 122 | 111 | 88 | 162 | 104 | 186 | 177 | 209 | 207 | 181 | 151 | 134 | 167 | .187 |
| | | 1963 | 2,668 | 40,800 | 123 | 91 | 113 | 137 | 110 | 149 | 168 | 199 | 213 | 163 | 120 | 128 | 146 | .164 |
| | | 1964 | 2,872 | 40,000 | 126 | 111 | 124 | 136 | 163 | 169 | 178 | 193 | 231 | 183 | 125 | 112 | 156 | .175 |
| | | 1965 | 3,171 | 54,261 | 98 | 109 | 104 | 117 | 162 | 187 | 168 | 190 | 213 | 207 | 136 | 111 | 140 | .187 |

* Refer to last page of Appendix C for abbreviations.

TABLE 12e
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

| County City | Agency (Name and Type) * | Year of Record | Annual Water Info System (million gals.) | Estimated Average Population Served | Average Daily Water Use Monthly (gpcd) | | | | | | | | | | | | Total | |
|------------------------|--|----------------------|---|--|---|-----|-----|-----|-----|-----|-----|-------|-----|-----|-----|-----|-------|------|
| | | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | gpcd | afy |
| SUTTE | | | | | | | | | | | | | | | | | | |
| Chico | Cal. Water Service Co. (C.W.S.C.) | 1960 | 3,683 | 29,492 | 112 | 106 | 141 | 245 | 342 | 718 | 757 | 667 | 485 | 266 | 132 | 95 | 339 | .380 |
| | | 1961 | 3,781 | 30,326 | 96 | 102 | 110 | 270 | 354 | 689 | 803 | 644 | 423 | 292 | 182 | 108 | 339 | .380 |
| | | 1962 | 3,879 | 31,330 | 118 | 117 | 140 | 320 | 414 | 644 | 759 | 660 | 475 | 181 | 130 | 112 | 342 | .383 |
| | | 1963 | 3,503 | 31,364 | 119 | 117 | 147 | 319 | 410 | 692 | 642 | 455 | 204 | 115 | 112 | 305 | .342 | |
| | | 1964 | 4,181 | 31,365 | 146 | 148 | 191 | 357 | 441 | 544 | 752 | 708 | 445 | 338 | 122 | 115 | 356 | .399 |
| | | | | | | | | | | | | | | | | | | |
| Gridley | - M.W.D. | 1960 | 307 | 3,393 | 162 | 121 | 135 | 199 | 297 | 300 | 518 | 305 | 342 | 210 | 133 | 159 | 248 | .278 |
| | | 1961 | 337 | 3,500 | 104 | 104 | 123 | 245 | 295 | 479 | 543 | 467 | 332 | 288 | 159 | 118 | 266 | .298 |
| | | 1962 | 331 | 3,484 | 127 | 113 | 130 | 246 | 320 | 467 | 526 | 455 | 333 | 175 | 136 | 128 | 263 | .295 |
| | | 1963 | 300 | 3,447 | 132 | 123 | 142 | 131 | 269 | 437 | 487 | 461 | 290 | 170 | 107 | 120 | 239 | .268 |
| | | 1964 | 348 | 3,446 | 112 | 130 | 152 | 259 | 345 | 427 | 515 | 507 | 341 | 240 | 120 | 120 | 272 | .305 |
| | | | | | | | | | | | | | | | | | | |
| Oroville | Cal. Water Service Co. (C.W.S.C.) | 1961 | 1,270 | 10,200 | 167 | 154 | 155 | 210 | 282 | 533 | 675 | 710 | 570 | 330 | 195 | 168 | 341 | .382 |
| | | 1962 | 1,276 | 10,200 | 155 | 143 | 152 | 284 | 320 | 500 | 566 | 730 | 640 | 288 | 156 | 180 | 345 | .366 |
| | | 1963 | 1,294 | 10,200 | 183 | 157 | 171 | 157 | 266 | 460 | 536 | 700 | 615 | 246 | 163 | 167 | 318 | .356 |
| | | 1964 | 1,132 | 10,200 | 164 | 178 | 190 | 255 | 330 | 430 | 595 | 740 | 645 | 316 | 157 | 154 | 346 | .388 |
| | | 1965 | 1,635 | 10,200 | 152 | 157 | 155 | 238 | 307 | 467 | 575 | 730 | 595 | 268 | 78 | 153 | 331 | .371 |
| | | | | | | | | | | | | | | | | | | |
| Paradise | - I.D. | 1957 | 1,207 | 9,475 | - | 88 | - | 82 | - | 269 | - | 1,008 | - | 568 | - | 80 | 349 | .391 |
| | | 1958 | 1,442 | 9,381 | - | 68 | - | 68 | - | 380 | - | 955 | - | 752 | - | 167 | 398 | .446 |
| | | 1959 | 1,640 | 10,525 | - | 81 | - | 111 | - | 528 | - | 1,246 | - | 636 | - | 270 | 479 | .536 |
| | | 1960 | 1,751 | 11,300 | - | 94 | - | 97 | - | 303 | - | 1,049 | - | 817 | - | 165 | 421 | .472 |
| | | 1961 | 1,855 | 12,400 | - | 65 | - | 113 | - | 257 | - | 1,038 | - | 763 | - | 202 | 406 | .455 |
| | | 1962 | 1,711 | 13,600 | - | 89 | - | 89 | - | 374 | - | 751 | - | 635 | - | 114 | 342 | .383 |
| | | 1963 | 1,415 | 15,100 | - | 77 | - | 74 | - | 164 | - | 610 | - | 541 | - | 84 | 259 | .289 |
| | | 1964 | 1,727 | 17,100 | - | 64 | - | 77 | - | 271 | - | 591 | - | 526 | - | 118 | 275 | .308 |
| | | | | | | | | | | | | | | | | | | |
| GLENN | | | | | | | | | | | | | | | | | | |
| Hamilton City | Cal. Water Service (C.W.S.C.) | 1960 | 75 | 722 | 105 | 114 | 128 | 226 | 304 | 571 | 567 | 537 | 393 | 244 | 135 | 99 | 285 | .319 |
| | | 1961 | 79 | 730 | 99 | 97 | 107 | 242 | 361 | 530 | 611 | 578 | 368 | 253 | 169 | 95 | 305 | .340 |
| | | 1962 | 75 | 713 | 140 | 123 | 135 | 304 | 395 | 517 | 542 | 489 | 372 | 184 | 145 | 131 | 290 | .325 |
| | | 1963 | 69 | 707 | 130 | 121 | 139 | 116 | 269 | 524 | 565 | 456 | 372 | 181 | 128 | 117 | 263 | .295 |
| | | 1964 | 86 | 744 | 116 | 143 | 160 | 342 | 403 | 475 | 610 | 527 | 321 | 292 | 107 | 106 | 315 | .351 |
| | | | | | | | | | | | | | | | | | | |
| Willows | Cal. Water Service Co. (C.W.S.C.) | 1960 | 404 | 4,025 | 115 | 113 | 137 | 211 | 286 | 551 | 547 | 475 | 362 | 235 | 135 | 114 | 273 | .306 |
| | | 1961 | 400 | 4,074 | 110 | 110 | 116 | 288 | 288 | 486 | 584 | 461 | 330 | 240 | 161 | 120 | 269 | .301 |
| | | 1962 | 381 | 4,123 | 123 | 112 | 115 | 233 | 296 | 446 | 526 | 449 | 345 | 156 | 119 | 102 | 252 | .282 |
| | | 1963 | 362 | 4,134 | 111 | 104 | 118 | 112 | 247 | 446 | 515 | 487 | 408 | 191 | 140 | 144 | 252 | .282 |
| | | 1964 | 460 | 4,185 | 142 | 186 | 182 | 300 | 370 | 463 | 548 | 500 | 355 | 277 | 118 | 113 | 300 | .336 |
| | | | | | | | | | | | | | | | | | | |
| LAKE | | | | | | | | | | | | | | | | | | |
| Clearlake Highlands | Highland Water Company (U.M.W.C.) | 1961 | 46 | 1,153 | - | - | - | - | - | - | - | - | - | - | - | - | 109 | .122 |
| | | 1962 | 56 | 1,272 | - | - | - | - | - | - | - | - | - | - | - | - | 121 | .136 |
| | | 1963 | 61 | 1,437 | - | - | - | - | - | - | - | - | - | - | - | - | 120 | .134 |
| | | 1964 | 64 | 1,500 | 72 | 77 | 80 | 124 | 130 | 190 | 274 | 238 | 201 | 142 | 80 | 80 | 141 | .134 |
| | | 1965 | 77 | 1,606 | 74 | 72 | 83 | 86 | 60 | 201 | 250 | 187 | 168 | 135 | 86 | 89 | 134 | .128 |
| | | | | | | | | | | | | | | | | | | |
| Kelseyville | Kelseyville County Waterworks #1 (U.M.W.C.) | 1961 | 28 | 310 | - | - | - | - | - | - | - | - | - | - | - | - | 83 | .093 |
| | | 1962 | 30 | 310 | - | - | - | - | - | - | - | - | - | - | - | - | 89 | .100 |
| | | 1963 | 32 | 310 | - | - | - | - | - | - | - | - | - | - | - | - | 94 | .104 |
| | | 1964 | 31 | 310 | 35 | 38 | 58 | 49 | 101 | 164 | 168 | 169 | 131 | 90 | 64 | 52 | 94 | .105 |
| | | 1965 | 32 | 319 | 38 | 54 | 83 | 100 | 146 | 183 | 176 | 121 | 90 | 44 | 37 | 36 | 92 | .103 |
| | | | | | | | | | | | | | | | | | | |
| Lakeport | - M.W.D. | 1961 | 136 | 2,392 | - | - | - | - | - | - | - | - | - | - | - | - | 156 | .175 |
| | | 1962 | 157 | 2,481 | - | - | - | - | - | - | - | - | - | - | - | - | 173 | .194 |
| | | 1963 | 147 | 2,570 | - | - | - | - | - | - | - | - | - | - | - | - | 159 | .178 |
| | | 1964 | 232 | 2,558 | 120 | 111 | 125 | 171 | 277 | 426 | 545 | 440 | 380 | 250 | 140 | 102 | 235 | .267 |
| | | 1965 | 217 | 2,797 | 116 | 114 | 124 | 172 | 264 | 395 | 446 | 364 | 241 | 220 | 140 | 131 | 216 | .242 |

* Refer to last page of Appendix C for abbreviations.

TABLE 10e
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

| County City | Agency (Name and Type)* | Year of Record | Annual Water Into System (million gals.) | Estimated Average Population Served | Average Daily Water Use | | | | | | | | | | | | Total | | | |
|--|--------------------------------------|--------------------|---|--|-------------------------|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|-------|-------------------|-----|------|
| | | | | | Monthly (gpcd) | | | | | | | | | | | | gpcd | annually agpcy | | |
| | | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | | | |
| PLACER Placer County FootHill Cities | Pacific Gas and Electric (C.W.C.) | 1960 | 1,285 | 11,007 | 172 | 134 | 134 | 153 | 176 | 336 | 490 | 576 | 500 | 370 | 260 | 156 | 288 | .323 | | |
| | | 1961 | 1,293 | 11,488 | 121 | 134 | 121 | 136 | 177 | 288 | 518 | 571 | 495 | 352 | 258 | 162 | 278 | .311 | | |
| | | 1962 | 1,421 | 11,947 | 138 | 152 | 124 | 147 | 246 | 344 | 500 | 550 | 580 | 394 | 196 | 153 | 294 | .329 | | |
| | | 1963 | 1,328 | 12,025 | 153 | 160 | 142 | 149 | 163 | 297 | 482 | 494 | 500 | 361 | 194 | 175 | 273 | .306 | | |
| | | 1964 | 1,364 | 12,150 | 169 | 186 | 166 | 185 | 252 | 332 | 453 | 547 | 498 | 393 | 206 | 187 | 305 | .342 | | |
| SACRAMENTO Sacramento | - M.W.D. | 1961 | 17,625 | 181,400 | 158 | 160 | 164 | 218 | 300 | 388 | 434 | 372 | 314 | 267 | 194 | 150 | 260 | .291 | | |
| | | 1962 | 18,121 | 189,500 | 150 | 149 | 160 | 272 | 310 | 382 | 470 | 380 | 331 | 216 | 172 | 149 | 262 | .293 | | |
| | | 1963 | 16,185 | 189,500 | 151 | 148 | 162 | 156 | 229 | 323 | 390 | 392 | 325 | 208 | 152 | 152 | 234 | .262 | | |
| | | 1964 | 21,162 | 211,600 | 137 | 164 | 195 | 238 | 312 | 360 | 450 | 425 | 375 | 285 | 187 | 160 | 274 | .307 | | |
| | | 1965 | 21,813 | 266,800 | 125 | 132 | 162 | 170 | 246 | 330 | 382 | 330 | 320 | 250 | 107 | 136 | 224 | .251 | | |
| SHASTA Redding | - M.W.D. | 1960 | 1,367 | 13,336 | 147 | 157 | 178 | 201 | 221 | 474 | 566 | 488 | 329 | 232 | 158 | 144 | 280 | .313 | | |
| | | 1961 | 1,321 | 14,791 | 135 | 131 | 128 | 200 | 181 | 391 | 480 | 440 | 314 | 213 | 167 | 137 | 244 | .272 | | |
| | | 1962 | 1,402 | 15,049 | 149 | 151 | 165 | 225 | 222 | 395 | 544 | 409 | 394 | 151 | 152 | 141 | 255 | .286 | | |
| | | 1963 | 1,350 | 15,114 | 133 | 126 | 132 | 127 | 222 | 390 | 470 | 476 | 339 | 212 | 156 | 134 | 245 | .274 | | |
| | | 1964 | 1,461 | 15,266 | 125 | 142 | 177 | 243 | 282 | 348 | 475 | 476 | 333 | 272 | 132 | 126 | 262 | .293 | | |
| SUTTER Live Oak | - M.W.D. | 1960 | 160 | 2,210 | 78 | 70 | 64 | 97 | 250 | 338 | 394 | 417 | 292 | 176 | 117 | 97 | 199 | .283 | | |
| | | 1959 | 186 | 2,284 | 71 | 68 | 120 | 213 | 315 | 433 | 465 | 380 | 231 | 177 | 149 | 102 | 227 | .254 | | |
| | | 1960 | 189 | 2,290 | 85 | 92 | 105 | 170 | 275 | 460 | 464 | 392 | 279 | 172 | 143 | 77 | 226 | .253 | | |
| | | 1961 | 201 | 2,323 | 87 | 80 | 90 | 166 | 274 | 368 | 484 | 431 | 412 | 201 | 133 | 115 | 237 | .265 | | |
| | | 1962 | 212 | 2,356 | 125 | 115 | 100 | 236 | 303 | 416 | 501 | 425 | 345 | 155 | 114 | 98 | 246 | .276 | | |
| TULARE Corning | - M.W.D. | 1956 | 263 | 2,818 | 174 | 160 | 150 | 165 | 204 | 358 | 443 | 413 | 311 | 257 | 212 | 223 | 256 | .287 | | |
| | | 1957 | 338 | 2,875 | 224 | 221 | 191 | 197 | 249 | 448 | 570 | 697 | 491 | 293 | 204 | 172 | 322 | .361 | | |
| | | 1958 | 276 | 2,915 | 187 | 149 | 130 | 122 | 202 | 290 | 417 | 471 | 427 | 292 | 213 | 202 | 259 | .290 | | |
| | | 1959 | 332 | 2,962 | 201 | 206 | 205 | 313 | 284 | 458 | 527 | 455 | 319 | 245 | 238 | 210 | 307 | .356 | | |
| | | 1960 | 322 | 3,022 | 201 | 167 | 153 | 174 | 180 | 453 | 516 | 535 | 415 | 279 | 205 | 229 | 292 | .327 | | |
| YUBA Marysville | Cal. Water Service Co. (C.W.C.) | 1960 | 276 | 2,926 | 187 | 149 | 129 | 122 | 201 | 290 | 417 | 471 | 426 | 292 | 213 | 202 | 258 | .289 | | |
| | | 1965 | 351 | 3,475 | 168 | 164 | 150 | 233 | 261 | 371 | 639 | 326 | 307 | 315 | 187 | 191 | 277 | .310 | | |
| | | 1966 | 354 | 3,475 | 177 | 167 | 283 | 291 | 365 | 562 | 345 | 553 | 312 | 246 | 154 | 174 | 303 | .339 | | |
| | | YUBA Marysville | Cal. Water Service Co. (C.W.C.) | 1960 | 924 | 9,534 | 131 | 134 | 143 | 191 | 258 | 483 | 499 | 453 | 350 | 236 | 147 | 142 | 264 | .296 |
| | | | | 1961 | 991 | 9,951 | 137 | 135 | 140 | 209 | 257 | 465 | 536 | 479 | 338 | 242 | 177 | 135 | 271 | .304 |
| 1962 | 1,024 | | | 10,018 | 152 | 165 | 161 | 238 | 300 | 449 | 514 | 474 | 386 | 243 | 200 | 165 | 287 | .322 | | |
| 1963 | 972 | | | 9,965 | 161 | 153 | 141 | 244 | 260 | 421 | 483 | 477 | 361 | 230 | 161 | 175 | 266 | .298 | | |
| 1964 | 1,089 | | | 9,844 | 176 | 187 | 196 | 270 | 339 | 404 | 514 | 485 | 381 | 297 | 185 | 162 | 301 | .337 | | |
| 1965 | 1,048 | 9,900 | 182 | 200 | 164 | 300 | 246 | 400 | 550 | 470 | 320 | 294 | 182 | 173 | 290 | .325 | | | | |

* Refer to last page of Appendix C for abbreviations.

TABLE 10f
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

| | | Average Daily Water Use | | | | | | | | | | | | | | | | | Total | |
|---------------------------------|------------------------------------|-------------------------|---|--|----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------|-------|-------|--|
| County City | Agency (Name and Type) * | Year of Record | Annual Water Into System (million gals.) | Estimated Average Population Served | Monthly (gpcd) | | | | | | | | | | | | Annually | | | |
| | | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | gpcd | agpcy | | |
| MADER | | | | | | | | | | | | | | | | | | | | |
| Mader County Foothill Cities | P. G. & E. (C.W.C.) | 1960 | 306 | 3,174 | 190 | 216 | 118 | 213 | 164 | 283 | 365 | 384 | 511 | 343 | 379 | 297 | 289 | .324 | | |
| | | 1961 | 341 | 3,303 | 200 | 224 | 155 | 144 | 180 | 284 | 293 | 390 | 370 | 362 | 247 | 196 | 254 | .285 | | |
| | | 1962 | 447 | 3,363 | 166 | 187 | 192 | 170 | 260 | 344 | 425 | 422 | 527 | 419 | 348 | 470 | 328 | .367 | | |
| | | 1963 | 519 | 3,417 | 238 | 401 | 328 | 282 | 350 | 378 | 493 | 443 | 465 | 449 | 376 | 339 | 378 | .423 | | |
| | | 1964 | 468 | 3,456 | 245 | 273 | 250 | 232 | 400 | 302 | 370 | 476 | 481 | 394 | 391 | 224 | 332 | .372 | | |
| SAN JOAQUIN | | | | | | | | | | | | | | | | | | | | |
| Stockton | Cal. Water Service Co. (C.W.C.) | 1960 | 7,482 | 87,048 | 111 | 101 | 110 | 175 | 312 | 320 | 382 | 414 | 390 | 300 | 196 | 109 | 243 | .272 | | |
| | | 1961 | 7,564 | 87,575 | 106 | 100 | 112 | 161 | 192 | 291 | 416 | 389 | 413 | 278 | 233 | 130 | 235 | .263 | | |
| | | 1962 | 7,417 | 88,476 | 102 | 111 | 104 | 152 | 232 | 315 | 356 | 373 | 425 | 292 | 303 | 128 | 241 | .270 | | |
| | | 1963 | 7,014 | 89,346 | 111 | 115 | 119 | 124 | 143 | 177 | 341 | 394 | 400 | 287 | 149 | 110 | 206 | .233 | | |
| | | 1964 | 7,788 | 89,346 | 113 | 122 | 136 | 169 | 240 | 288 | 353 | 402 | 411 | 310 | 185 | 120 | 237 | .265 | | |
| 1965 | 7,620 | 89,600 | 114 | 115 | 134 | 150 | 208 | 323 | 375 | 380 | 400 | 304 | 217 | 133 | 233 | 233 | .267 | | | |
| STANISLA | | | | | | | | | | | | | | | | | | | | |
| Yacerville | - M.W.D. | 1960 | 734 | 10,917 | 70 | 98 | 81 | 112 | 213 | 254 | 272 | 312 | 280 | 233 | 162 | 110 | 183 | .205 | | |
| | | 1961 | 775 | 11,377 | 79 | 66 | 99 | 130 | 186 | 259 | 329 | 316 | 254 | 227 | 171 | 114 | 186 | .200 | | |
| | | 1962 | 844 | 11,667 | 95 | 94 | 90 | 149 | 212 | 297 | 312 | 314 | 275 | 203 | 188 | 142 | 198 | .222 | | |
| | | 1964 | 907 | 14,280 | 79 | 98 | 92 | 144 | 179 | 235 | 286 | 293 | 257 | 213 | 166 | 99 | 173 | .194 | | |
| | | 1965 | 902 | 14,355 | 99 | 98 | 107 | 118 | 215 | 266 | 316 | 305 | 254 | 226 | 145 | 91 | 187 | .209 | | |

* Refer to last page of Appendix C for abbreviations.

TABLE 10g
MONTHLY AND ANNUAL URBAN WATER USE
AGENCY PRODUCED WATER
CAPACITY

| County City | Agency (Name and Type)* | Year of Record | Annual Water Into System (million gals.) | Estimated Average Population Served | Average Daily Water Use Monthly (gpcd) | | | | | | | | | | | | Total | |
|----------------|-------------------------------------|----------------------|---|--|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------|------|
| | | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | gpcd | afpy |
| | | | | | | | | | | | | | | | | | Annually | |
| MADERA | | 1960 | - | 14,800 | - | - | - | 284 | 473 | 633 | 689 | 632 | 476 | 300 | 225 | 165 | - | - |
| Madera | - M.W.D. | 1963 | 1,844 | 15,000 | 167 | 151 | 203 | 191 | 402 | 593 | 668 | 619 | 454 | 262 | 158 | 145 | 334 | 374 |
| | | 1964 | 2,096 | 15,300 | 144 | 210 | 221 | 346 | 458 | 577 | 710 | 644 | 453 | 346 | 161 | 141 | 370 | 414 |
| | | 1965 | 2,080 | 16,100 | 135 | 162 | 219 | 259 | 498 | 575 | 664 | 612 | 444 | 329 | 179 | 143 | 352 | 374 |
| MERCED | | | | | | | | | | | | | | | | | | |
| Castle Gardens | U. S. Air Force | 1960 | 316 | 3,000 | 64 | 72 | 233 | 361 | 332 | 537 | 585 | 435 | 275 | 217 | 144 | 89 | 289 | 324 |
| | | 1961 | 310 | 3,000 | 64 | 79 | 234 | 271 | 399 | 565 | 559 | 478 | 370 | 195 | 77 | 66 | 280 | 314 |
| | | 1962 | 285 | 3,000 | 70 | 87 | 152 | 277 | 327 | 457 | 510 | 460 | 232 | 228 | 124 | 72 | 257 | 288 |
| | | 1963 | 320 | 3,000 | 55 | 71 | 146 | 356 | 399 | 544 | 587 | 516 | 392 | 174 | 122 | 104 | 289 | 324 |
| | | 1964 | 332 | 3,000 | 123 | 128 | 200 | 176 | 407 | 601 | 610 | 555 | 436 | 209 | 73 | 69 | 298 | 334 |
| | | 1965 | 398 | 3,000 | 95 | 203 | 282 | 393 | 477 | 497 | 703 | 560 | 428 | 374 | 180 | 116 | 359 | 402 |
| Los Banos | - M.W.D. | 1964 | - | 9,943 | - | - | - | - | - | - | 341 | 318 | 241 | 176 | 109 | 95 | - | - |
| | | 1965 | 745 | 10,164 | 100 | 110 | 140 | 145 | 269 | 298 | 341 | 316 | 242 | 228 | 114 | 99 | 201 | 225 |
| | | 1966 | 761 | 10,345 | 88 | 113 | 128 | 194 | 228 | 221 | 332 | 389 | 282 | 219 | 118 | 100 | 202 | 226 |
| Merced | - M.W.D. | 1951 | 1,657 | 17,000 | 111 | 111 | 179 | 247 | 318 | 498 | 486 | 457 | 357 | 231 | 144 | 118 | 267 | 290 |
| | | 1952 | 1,708 | 18,500 | 103 | 102 | 118 | 167 | 333 | 385 | 496 | 455 | 338 | 251 | 132 | 122 | 253 | 283 |
| | | 1953 | 1,900 | 19,500 | 110 | 135 | 177 | 243 | 278 | 374 | 553 | 457 | 370 | 242 | 143 | 123 | 267 | 299 |
| | | 1954 | 1,960 | 20,500 | 109 | 112 | 120 | 222 | 341 | 427 | 550 | 427 | 337 | 247 | 130 | 110 | 262 | 293 |
| | | 1955 | 2,119 | 21,500 | 101 | 106 | 170 | 126 | 288 | 454 | 493 | 501 | 388 | 248 | 140 | 108 | 270 | 302 |
| | | 1956 | 2,136 | 22,500 | 101 | 104 | 182 | 207 | 279 | 469 | 528 | 463 | 351 | 213 | 152 | 123 | 265 | 297 |
| | | 1957 | 2,359 | 23,500 | 106 | 108 | 141 | 240 | 284 | 519 | 585 | 504 | 377 | 181 | 135 | 112 | 275 | 308 |
| | | 1958 | 2,497 | 24,000 | 104 | 108 | 107 | 185 | 352 | 441 | 554 | 566 | 395 | 287 | 172 | 138 | 285 | 319 |
| | | 1959 | 2,790 | 24,500 | 107 | 115 | 190 | 297 | 363 | 550 | 630 | 538 | 330 | 263 | 194 | 147 | 312 | 349 |
| | | 1960 | 2,900 | 25,000 | 116 | 117 | 192 | 244 | 384 | 617 | 640 | 572 | 429 | 276 | 128 | 118 | 320 | 358 |
| | | 1961 | 3,042 | 25,000 | 119 | 128 | 158 | 250 | 341 | 600 | 687 | 620 | 422 | 313 | 183 | 128 | 332 | 372 |
| | | 1962 | 3,021 | 25,500 | 122 | 118 | 150 | 324 | 406 | 563 | 649 | 587 | 428 | 234 | 174 | 127 | 324 | 363 |
| | | 1963 | 2,768 | 26,000 | 128 | 177 | 158 | 140 | 315 | 518 | 619 | 582 | 421 | 297 | 127 | 122 | 290 | 325 |
| | | 1964 | 3,158 | 26,500 | 123 | 158 | 166 | 232 | 401 | 548 | 630 | 556 | 415 | 323 | 137 | 129 | 325 | 364 |
| | | 1965 | 3,210 | 27,000 | 126 | 144 | 186 | 215 | 456 | 529 | 642 | 567 | 412 | 311 | 173 | 138 | 324 | 363 |
| STANISLAUS | | | | | | | | | | | | | | | | | | |
| Ceres | Ceres Water Works, Inc. (C.W.W.) | 1961 | 280 | 4,100 | 81 | 50 | 101 | 175 | 300 | 323 | 316 | 305 | 261 | 173 | 141 | 86 | 187 | 207 |
| | | 1962 | 294 | 4,400 | 79 | 65 | 84 | 146 | 281 | 311 | 304 | 286 | 263 | 163 | 120 | 84 | 181 | 205 |
| | | 1963 | 289 | 4,600 | 89 | 97 | 101 | 93 | 165 | 288 | 303 | 333 | 256 | 136 | 117 | 79 | 172 | 193 |
| | | 1964 | 335 | 4,700 | 87 | 110 | 103 | 179 | 225 | 269 | 325 | 351 | 265 | 211 | 117 | 91 | 195 | 218 |
| | | 1965 | 361 | 5,000 | 95 | 109 | 127 | 109 | 260 | 292 | 337 | 293 | 273 | 219 | 150 | 92 | 198 | 222 |
| Modesto | - M.W.D. | 1961 | 4,317 | 31,700 | 132 | 145 | 189 | 329 | 351 | 549 | 611 | 603 | 405 | 379 | 212 | 139 | 351 | 371 |
| | | 1962 | 4,573 | 36,000 | 131 | 124 | 161 | 358 | 428 | 554 | 605 | 616 | 512 | 320 | 207 | 144 | 348 | 390 |
| | | 1963 | 4,401 | 37,000 | 140 | 138 | 168 | 150 | 349 | 524 | 593 | 622 | 547 | 304 | 148 | 132 | 319 | 357 |
| | | 1964 | 5,364 | 39,400 | 128 | 173 | 206 | 348 | 432 | 512 | 664 | 682 | 267 | 446 | 160 | 146 | 373 | 418 |
| | | 1965 | 4,956 | 41,400 | 134 | 167 | 221 | 224 | 469 | 544 | 670 | 638 | 553 | 418 | 199 | 160 | 388 | 367 |

* Refer to last page of Appendix C for abbreviations.

TULARE LAKE BASIN
Hydrographic Area

TABLE 12h
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

| County City | Agency (Name and Type)* | Year of Record | Annual Water Into System (million gals.) | Estimated Average Population Served | Average Daily Water Use Monthly (gpcd) | | | | | | | | | | | | Total | |
|----------------|----------------------------|-------------------|---|--|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|------|
| | | | | | Monthly (gpcd) | | | | | | | | | | | | gpcd | afpy |
| | | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| FRESNO | | | | | | | | | | | | | | | | | | |
| Fresno | - M.W.D. | 1941 | 8,904 | 74,200 | 119 | 120 | 195 | 231 | 478 | 580 | 674 | 964 | 457 | 272 | 175 | 135 | 331 | .371 |
| | | 1942 | 9,570 | 77,800 | 124 | 133 | 201 | 286 | 420 | 616 | 692 | 592 | 436 | 311 | 194 | 127 | 337 | .377 |
| | | 1943 | 10,325 | 81,000 | 124 | 137 | 140 | 263 | 531 | 596 | 680 | 607 | 487 | 318 | 203 | 152 | 356 | .399 |
| | | 1944 | 10,797 | 95,000 | 133 | 135 | 245 | 298 | 470 | 569 | 660 | 611 | 477 | 306 | 147 | 135 | 350 | .392 |
| | | 1945 | 11,125 | 88,600 | 135 | 144 | 147 | 350 | 475 | 589 | 691 | 593 | 469 | 245 | 165 | 140 | 345 | .386 |
| | | 1946 | 11,678 | 92,200 | 134 | 146 | 189 | 381 | 462 | 575 | 654 | 605 | 445 | 245 | 178 | 148 | 340 | .390 |
| | | 1947 | 12,238 | 95,800 | 147 | 161 | 258 | 386 | 509 | 575 | 625 | 532 | 449 | 243 | 164 | 149 | 351 | .350 |
| | | 1948 | 11,574 | 99,400 | 180 | 170 | 163 | 205 | 340 | 514 | 602 | 594 | 444 | 293 | 213 | 139 | 319 | .357 |
| | | 1949 | 12,670 | 101,000 | 142 | 180 | 198 | 361 | 447 | 611 | 640 | 531 | 454 | 116 | 172 | 143 | 343 | .384 |
| | | 1950 | 13,540 | 106,600 | 136 | 150 | 218 | 337 | 485 | 582 | 666 | 578 | 426 | 298 | 159 | 139 | 341 | .382 |
| | | 1951 | 13,605 | 111,300 | 132 | 139 | 248 | 347 | 441 | 593 | 613 | 553 | 449 | 300 | 185 | 134 | 342 | .383 |
| | | 1952 | 13,124 | 115,000 | 128 | 136 | 153 | 239 | 450 | 480 | 593 | 543 | 425 | 325 | 188 | 133 | 317 | .355 |
| | | 1953 | 13,349 | 120,700 | 124 | 162 | 220 | 320 | 343 | 439 | 612 | 511 | 436 | 293 | 170 | 141 | 315 | .353 |
| | | 1954 | 13,869 | 125,400 | 132 | 138 | 194 | 303 | 453 | 504 | 619 | 521 | 421 | 310 | 170 | 132 | 323 | .362 |
| | | 1955 | 15,027 | 134,100 | 119 | 127 | 218 | 253 | 341 | 502 | 536 | 538 | 437 | 298 | 178 | 127 | 307 | .344 |
| | | 1956 | 16,344 | 136,100 | 117 | 129 | 248 | 277 | 367 | 568 | 633 | 555 | 464 | 241 | 195 | 146 | 329 | .368 |
| | | 1957 | 16,534 | 142,900 | 126 | 130 | 200 | 293 | 308 | 570 | 648 | 558 | 434 | 246 | 153 | 124 | 317 | .355 |
| | | 1958 | 17,515 | 137,500 | 124 | 125 | 129 | 256 | 447 | 566 | 664 | 667 | 451 | 362 | 208 | 164 | 349 | .391 |
| | | 1959 | 13,744 | 145,000 | 131 | 144 | 268 | 388 | 449 | 610 | 706 | 609 | 411 | 329 | 226 | 172 | 374 | .419 |
| | | 1960 | 19,439 | 149,600 | 133 | 134 | 227 | 320 | 446 | 672 | 680 | 603 | 467 | 303 | 147 | 134 | 356 | .399 |
| | | 1961 | 19,699 | 155,700 | 133 | 155 | 206 | 328 | 371 | 579 | 667 | 594 | 432 | 320 | 198 | 164 | 346 | .388 |
| | | 1962 | 19,138 | 161,900 | 135 | 121 | 163 | 336 | 396 | 594 | 629 | 568 | 447 | 250 | 185 | 145 | 326 | .365 |
| | | 1963 | 17,938 | 166,800 | 138 | 135 | 163 | 326 | 495 | 593 | 552 | 420 | 242 | 179 | 123 | 204 | 329 | .359 |
| | | 1964 | 19,633 | 171,600 | 137 | 166 | 172 | 284 | 380 | 565 | 643 | 552 | 456 | 244 | 175 | 118 | 313 | .351 |
| | | 1965 | 19,415 | 173,700 | 136 | 142 | 180 | 333 | 438 | 545 | 583 | 524 | 426 | 275 | 166 | 108 | 313 | .350 |
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* Refer to last page of Appendix C for abbreviations.

TABLE 10h
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

| County City | Agency (Name and Type) * | Year of Record | Annual Water Into System (million gals.) | Estimated Average Population Served | Average Daily Water Use | | | | | | | | | | | | Total | |
|----------------|------------------------------------|-------------------|---|--|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------|-------|
| | | | | | Monthly (gpcd) | | | | | | | | | | | | Annually | |
| | | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | gpcd | afywy |
| KERN | | | | | | | | | | | | | | | | | | |
| Delano | - M.W.D. | 1961 | - | 12,300 | - | - | - | - | - | - | 693 | 945 | 430 | 308 | 220 | 103 | - | - |
| | | 1962 | 1,782 | 12,600 | 134 | 118 | 219 | 383 | 439 | 663 | 647 | 610 | 606 | 335 | 261 | 221 | 386 | 432 |
| | | 1963 | 1,759 | 12,900 | 219 | 176 | 281 | 333 | 545 | 522 | 627 | 751 | 375 | 275 | 194 | 163 | 372 | 417 |
| | | 1964 | 1,836 | 13,300 | 233 | 282 | 316 | 342 | 438 | 647 | 614 | 579 | 419 | 356 | 119 | 172 | 376 | 421 |
| | | 1965 | 1,822 | 13,500 | 121 | 247 | 236 | 309 | 465 | 515 | 730 | 582 | 455 | 377 | 217 | 160 | 368 | 412 |
| | | 1966 | 2,029 | 13,968 | 146 | 177 | 428 | 476 | 453 | 593 | 635 | 635 | 465 | 384 | 202 | 163 | 398 | 446 |
| KINGS | | | | | | | | | | | | | | | | | | |
| Hanford | - M.W.D. | 1944 | 816 | 9,800 | 115 | 118 | 169 | 201 | 304 | 339 | 398 | 362 | 261 | 201 | 125 | 120 | 228 | 255 |
| | | 1945 | 855 | 10,100 | 118 | 115 | 137 | 247 | 296 | 355 | 421 | 368 | 291 | 183 | 137 | 119 | 232 | 260 |
| | | 1946 | 897 | 10,500 | 115 | 121 | 178 | 232 | 309 | 370 | 417 | 380 | 282 | 165 | 129 | 113 | 234 | 262 |
| | | 1947 | 1,036 | 11,000 | 113 | 120 | 186 | 276 | 346 | 388 | 430 | 391 | 326 | 207 | 163 | 144 | 258 | 284 |
| | | 1948 | 1,072 | 11,700 | 166 | 171 | 162 | 203 | 276 | 375 | 435 | 398 | 323 | 199 | 155 | 117 | 251 | 281 |
| | | 1949 | 1,278 | 12,200 | 126 | 132 | 148 | 288 | 370 | 509 | 538 | 454 | 370 | 239 | 146 | 124 | 287 | 321 |
| | | 1950 | 1,267 | 12,900 | 119 | 138 | 180 | 261 | 387 | 443 | 504 | 436 | 295 | 214 | 142 | 110 | 269 | 301 |
| | | 1951 | 1,164 | 13,400 | 86 | 118 | 202 | 239 | 303 | 357 | 397 | 375 | 303 | 210 | 148 | 121 | 238 | 267 |
| | | 1952 | 1,244 | 13,800 | 111 | 124 | 135 | 209 | 356 | 369 | 479 | 419 | 310 | 212 | 139 | 98 | 247 | 277 |
| | | 1953 | 1,270 | 14,200 | 94 | 129 | 196 | 251 | 282 | 362 | 483 | 392 | 320 | 206 | 127 | 109 | 245 | 274 |
| | | 1954 | 1,277 | 14,400 | 114 | 113 | 133 | 233 | 338 | 403 | 498 | 383 | 291 | 210 | 122 | 95 | 243 | 272 |
| | | 1955 | 1,320 | 14,700 | 90 | 103 | 168 | 223 | 290 | 435 | 453 | 448 | 324 | 198 | 131 | 99 | 246 | 276 |
| | | 1956 | 1,358 | 15,000 | 92 | 97 | 191 | 209 | 295 | 439 | 472 | 411 | 327 | 163 | 150 | 121 | 248 | 278 |
| | | 1957 | 1,385 | 15,300 | 105 | 112 | 173 | 254 | 297 | 470 | 434 | 415 | 310 | 167 | 97 | 87 | 248 | 278 |
| | | 1958 | 1,349 | 15,600 | 85 | 85 | 91 | 165 | 324 | 409 | 470 | 455 | 273 | 224 | 133 | 117 | 237 | 265 |
| 1959 | 1,589 | 15,600 | 93 | 104 | 200 | 288 | 345 | 487 | 542 | 443 | 309 | 234 | 164 | 150 | 279 | 312 | | |
| 1960 | 1,637 | 15,900 | 114 | 110 | 189 | 266 | 370 | 543 | 537 | 464 | 367 | 212 | 112 | 95 | 282 | 316 | | |
| 1961 | 1,777 | 17,300 | 98 | 134 | 184 | 293 | 323 | 506 | 511 | 463 | 340 | 258 | 151 | 99 | 281 | 315 | | |
| 1962 | 1,752 | 17,700 | 101 | 95 | 130 | 291 | 351 | 462 | 503 | 457 | 341 | 213 | 161 | 130 | 270 | 302 | | |
| 1963 | 1,715 | 18,100 | 148 | 129 | 166 | 151 | 327 | 437 | 511 | 472 | 337 | 201 | 115 | 102 | 259 | 290 | | |
| 1964 | 1,873 | 18,600 | 109 | 171 | 196 | 264 | 353 | 456 | 515 | 449 | 310 | 252 | 110 | 102 | 274 | 307 | | |
| 1965 | 1,834 | 18,700 | 100 | 138 | 214 | 231 | 404 | 426 | 476 | 436 | 300 | 246 | 135 | 105 | 269 | 301 | | |
| TULARE | | | | | | | | | | | | | | | | | | |
| Tulare | - M.W.D. | 1961 | 1,777 | 14,300 | 105 | 135 | 205 | 326 | 429 | 638 | 671 | 572 | 408 | 296 | 177 | 111 | 339 | 380 |
| | | 1962 | 1,610 | 14,600 | 128 | 115 | 139 | 331 | 395 | 498 | 595 | 519 | 370 | 251 | 159 | 121 | 302 | 338 |
| | | 1963 | 1,555 | 14,800 | 172 | 132 | 174 | 163 | 373 | 491 | 573 | 502 | 378 | 226 | 137 | 128 | 287 | 321 |
| | | 1964 | 1,745 | 15,100 | 123 | 182 | 221 | 286 | 361 | 569 | 607 | 527 | 360 | 289 | 139 | 115 | 316 | 353 |
| | | 1965 | 1,762 | 15,700 | 106 | 150 | 249 | 239 | 402 | 512 | 557 | 545 | 359 | 254 | 181 | 119 | 306 | 342 |
| VISALIA | | | | | | | | | | | | | | | | | | |
| Visalia | Cal. Water Service Co. (C.W.C.) | 1944 | 1,274 | 11,600 | 144 | 143 | 221 | 239 | 387 | 494 | 537 | 497 | 393 | 260 | 149 | 145 | 301 | 337 |
| | | 1945 | 1,816 | 11,900 | 143 | 133 | 149 | 264 | 375 | 452 | 517 | 453 | 375 | 213 | 155 | 130 | 280 | 314 |
| | | 1946 | 1,846 | 12,600 | 122 | 137 | 191 | 280 | 351 | 498 | 508 | 429 | 347 | 167 | 143 | 123 | 271 | 304 |
| | | 1947 | 1,315 | 13,600 | 94 | 107 | 170 | 298 | 369 | 436 | 470 | 429 | 361 | 201 | 131 | 112 | 265 | 297 |
| | | 1948 | 1,181 | 15,200 | 141 | 129 | 134 | 176 | 272 | 403 | 472 | 426 | 344 | 211 | 165 | 109 | 249 | 279 |
| | | 1949 | 1,612 | 16,300 | 112 | 110 | 106 | 274 | 350 | 512 | 522 | 427 | 359 | 233 | 139 | 109 | 271 | 304 |
| | | 1950 | 1,734 | 17,400 | 92 | 119 | 175 | 273 | 393 | 452 | 535 | 475 | 312 | 222 | 127 | 95 | 273 | 306 |
| | | 1951 | 1,840 | 18,400 | 88 | 102 | 181 | 244 | 327 | 491 | 541 | 457 | 362 | 227 | 152 | 111 | 274 | 307 |
| | | 1952 | 1,909 | 19,300 | 108 | 128 | 630 | 203 | 406 | 433 | 516 | 471 | 341 | 249 | 142 | 101 | 271 | 304 |
| | | 1953 | 1,934 | 20,000 | 108 | 130 | 188 | 273 | 281 | 306 | 547 | 443 | 365 | 218 | 127 | 99 | 265 | 297 |
| | | 1954 | 2,040 | 20,700 | 106 | 98 | 118 | 254 | 393 | 460 | 581 | 443 | 335 | 235 | 122 | 93 | 270 | 302 |
| | | 1955 | 2,180 | 21,800 | 84 | 94 | 183 | 230 | 336 | 483 | 507 | 523 | 386 | 234 | 137 | 90 | 274 | 307 |
| | | 1956 | 2,156 | 22,900 | 89 | 94 | 183 | 174 | 283 | 474 | 539 | 450 | 354 | 176 | 157 | 115 | 258 | 289 |
| | | 1957 | 2,286 | 24,000 | 99 | 100 | 147 | 232 | 257 | 521 | 568 | 474 | 349 | 174 | 106 | 96 | 261 | 298 |
| | | 1958 | 2,461 | 24,700 | 92 | 92 | 92 | 168 | 355 | 463 | 567 | 573 | 338 | 251 | 141 | 128 | 273 | 306 |
| | | 1959 | 2,787 | 25,800 | 98 | 104 | 203 | 305 | 351 | 521 | 607 | 490 | 313 | 241 | 172 | 131 | 296 | 332 |
| | | 1960 | 2,836 | 26,900 | 103 | 95 | 165 | 242 | 353 | 598 | 588 | 508 | 389 | 220 | 106 | 95 | 289 | 324 |
| | | 1961 | 2,807 | 27,500 | 97 | 132 | 170 | 290 | 320 | 541 | 554 | 479 | 323 | 219 | 134 | 87 | 279 | 312 |
| | | 1962 | 2,724 | 28,200 | 90 | 87 | 109 | 275 | 322 | 480 | 538 | 476 | 251 | 183 | 141 | 116 | 264 | 296 |
| 1963 | 2,591 | 28,600 | 138 | 111 | 139 | 115 | 304 | 436 | 527 | 470 | 353 | 175 | 105 | 91 | 247 | 277 | | |
| 1964 | 2,844 | 29,600 | 98 | 154 | 163 | 221 | 320 | 448 | 539 | 467 | 295 | 230 | 102 | 101 | 262 | 293 | | |
| 1965 | 2,883 | 30,200 | 94 | 120 | 182 | 194 | 370 | 415 | 497 | 475 | 307 | 233 | 133 | 101 | 260 | 291 | | |

* Refer to last page of Appendix C for abbreviations.

SOUTH LARIMAN
Hydrographic Area

TABLE 121
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

| County City | Agency (Name and Type) * | Year of Record | Annual Water Into System (million gals.) | Estimated Average Population Served | Average Daily Water Use | | | | | | | | | | | | Total | |
|----------------|-----------------------------|----------------------|---|--|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------|------|
| | | | | | Monthly (gpcd) | | | | | | | | | | | | Annually | |
| | | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | gpcd | afpy |
| SAN BERNARDINO | | | | | | | | | | | | | | | | | | |
| Victorville | - C.W.D. | 1961 | 632 | 5,667 | 175 | 166 | 236 | 273 | 361 | 400 | 510 | 459 | 372 | 320 | 199 | 131 | 308 | .345 |
| | | 1962 | 728 | 6,963 | 116 | 118 | 153 | 278 | 272 | 390 | 470 | 489 | 456 | 314 | 217 | 142 | 285 | .319 |
| | | 1963 | 888 | 8,259 | 123 | 147 | 152 | 240 | 308 | 346 | 446 | 581 | 496 | 330 | 186 | 165 | 293 | .328 |
| | | 1964 | 1,171 | 9,655 | 138 | 150 | 177 | 285 | 318 | 488 | 562 | 586 | 543 | 344 | 236 | 150 | 331 | .371 |
| | | 1965 | 1,078 | 10,850 | 108 | 161 | 197 | 192 | 320 | 407 | 446 | 430 | 384 | 295 | 208 | 93 | 279 | .302 |

COLORADO DESERT
Hydrographic Area

TABLE 122
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

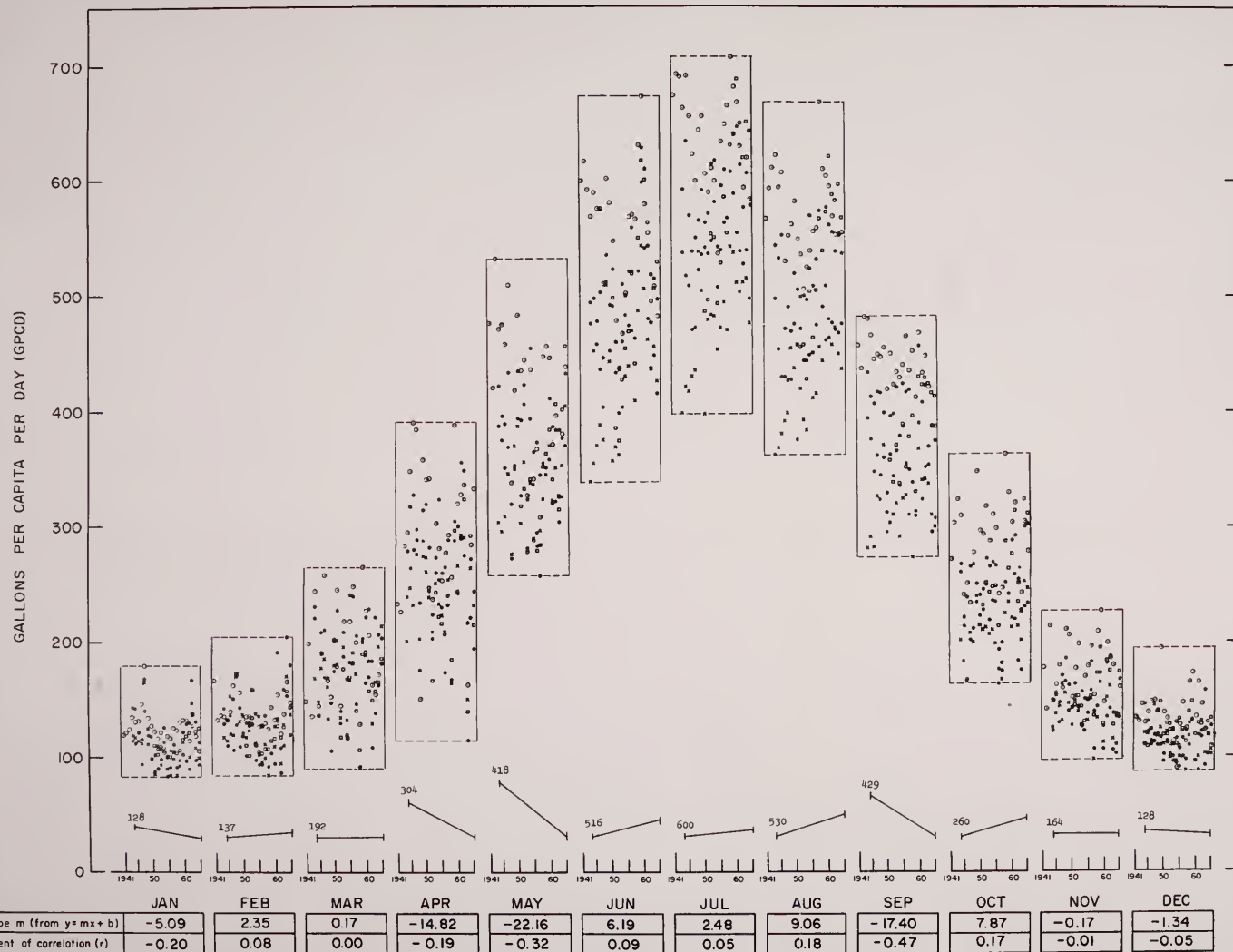
| County City | Agency (Name and Type) * | Year of Record | Annual Water Into System (million gals.) | Estimated Average Population Served | Average Daily Water Use | | | | | | | | | | | | Total | |
|----------------|-----------------------------|----------------------|---|--|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------|------|
| | | | | | Monthly (gpcd) | | | | | | | | | | | | Annually | |
| | | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | gpcd | afpy |
| IMPERIAL | | | | | | | | | | | | | | | | | | |
| El Centro | - M.W.D. | 1961 | 1,606 | 18,340 | 147 | 181 | 199 | 246 | 284 | 358 | 356 | 307 | 283 | 214 | 174 | 160 | 242 | .271 |
| | | 1962 | 1,763 | 18,340 | 152 | 165 | 189 | 244 | 289 | 373 | 393 | 386 | 340 | 273 | 198 | 149 | 263 | .295 |
| | | 1963 | 1,691 | 18,340 | 155 | 192 | 189 | 223 | 314 | 372 | 352 | 346 | 274 | 244 | 170 | 154 | 252 | .282 |
| | | 1964 | 1,632 | 18,751 | 128 | 132 | 199 | 224 | 277 | 340 | 383 | 338 | 268 | 238 | 166 | 151 | 238 | .267 |
| | | 1965 | 1,689 | 19,414 | 143 | 167 | 187 | 212 | 285 | 329 | 384 | 356 | 301 | 238 | 152 | 116 | 239 | .268 |
| RIVERSIDE | | | | | | | | | | | | | | | | | | |
| Indio | - M.W.D. | 1961 | 1,325 | 10,150 | 194 | 225 | 249 | 323 | 409 | 596 | 588 | 544 | 433 | 306 | 218 | 207 | 358 | .401 |
| | | 1962 | 1,438 | 11,000 | 177 | 178 | 216 | 356 | 381 | 517 | 642 | 603 | 471 | 316 | 246 | 188 | 358 | .401 |
| | | 1963 | 1,330 | 11,950 | 181 | 208 | 240 | 292 | 106 | 476 | 591 | 566 | 428 | 295 | 193 | 199 | 315 | .353 |
| | | 1964 | 1,556 | 13,450 | 166 | 195 | 208 | 257 | 354 | 450 | 519 | 524 | 397 | 334 | 206 | 183 | 316 | .354 |
| | | 1965 | 1,460 | 13,450 | 186 | 219 | 204 | 245 | 359 | 313 | 417 | 471 | 381 | 200 | 138 | 155 | 297 | .333 |

* The following abbreviations are used throughout Appendix C to denote the type of agency:

- C.S.D. - Community Services District
- C.W.C. - Commercial Water Company
- C.W.D. - County Water District
- C.W.W.D. - County Waterworks District
- I.D. - Irrigation District
- M.U.D. - Municipal Utility District
- M.W.D. - Municipal Water Department
- U.N.W.C. - Unincorporated Mutual Water Company

COLLATE: -

 1 PIECE~~s~~



- FRESNO (Municipal Water Department)
- VISALIA (California Water Service Co.)
- ★ BAKERSFIELD (California Water Service Co.)
- × HANFORD (Municipal Water Department)
- MERCED (Municipal Water Department)*

* MERCED INCLUDED FOR COMPARISON PURPOSES ONLY.

— LEGEND —



b - value
REGRESSION LINE
(Based on 1944-65 unit values weighted by population)

YEARS OF RECORD
1941 50 60

STATE OF CALIFORNIA
THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

MONTHLY URBAN PER CAPITA
WATER USE TRENDS
AGENCY PRODUCED WATER,
TULARE LAKE BASIN

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